Level: PhD

Course title: Effects of chemicals in biological systems (DSB618)

Status: elective

ECTS: 15

Requirements:

Learning objectives

The main learning objective is to enable PhD students to acquire knowledge about the close relationships of the physico-chemical properties of the drugs and toxins and their doses, with the bioavailability of substances in human organism. PhD students will acquire the knowledge about the factors that influence the initiation, intensity and duration of the therapeutic and toxic effects, as well as about the possible undesirable and toxic effects of the substance in the specific drug preparation forms. The program of the practical instruction will provide the analysis and determination of the most important physico-chemical and technological factors that may influence the kinetics of the drug release, both its therapeutic or toxic effects, and its absorption *in vivo,* in human organism. Students will acquire the knowledge and skills in the domain of the general toxicology, about the main groups of toxins, and about the different domains of toxicology (forensic toxicology, occupational toxicology, clinical toxicology, nutritional toxicology, drug toxicology, eco-toxicology, analytical toxicology, etc.).

Learning outcomes

Application of the acquired knowledge in practice and determination of the most important physico-chemical and technological factors that may influence the kinetics of the drug release, both its therapeutic or toxic effects, and its absorption *in vitro* and *in vivo,* in human organism. Understanding of the kinetic mechanisms that influence the substance in human tissues and organs, kinetic analyses and importance of kinetic parameters. Important prerequisites to perform the pharmacokinetic and toxicokinetic analyses.

Syllabus

Theoretical instruction

1. General introduction and basics of chemicals in biological systems
2. Definitions of the chemicals, drugs and toxins
3. Definition of toxins, doses, classification, factors determining the toxicity
4. Pharmacokinetics and toxicokinetics
5. Factors determining the variability of pharmacokinetic and toxicokinetic processes
6. Biological factors that determine the absorption of chemicals
7. Physico-chemical factors that influence the release and absorption of medicines.
8. Technological factors influencing the release and absorption of medicines.
9. Kinetic analysis of the drug release from the drug preparations in vitro.
10. Drug metabolism.
11. Drug excretion and elimination.
12. Pharmacokinetic analysis: from sampling to results interpretation.
13. Pharmacodynamics
14. Toxicodynamics
15. Toxicological analysis: from sampling to results interpretation
16. Toxicity mechanisms. Classification of intoxications.
17. Basics of mutagenicity, teratogenicity and carcinogenicity.
18. Fundamentals of the intoxication treatment and antidotes.

Practical instruction

Methods of analysis of factors that influence the kinetics and effects of chemicals: physico-chemical factors that influence the kinetics of the process of drug release (degree of ionization, pH value, partition coefficient, solubility, rate of dissolution, particle size); practical determination of partition coefficient, solubility, rate of dissolution, particle size, characteristics and role of biological system. Introduction to prepare the documents and preparation of documents necessary to perform the *in vitro* and *in vivo* experiments.				
Weekly teaching load: 10 (150)				Other:
Lectures: 5 (75)	Exercises:	Other forms of teaching:	Student research: 5 (75)	