TRACER KINETICS

Basic Information

This is a course, which contributes to MSc award in Biology

Course period	From September 1st till February 1st, 1 semester
Study credits	2 ECTS credits
Duration	72 hours
Language of instruction	English
Academic requirements	- BSc degree in Biology, Chemistry, Physics or Environmental Sciences or equivalent (transcript of records), - Good command of English (certificate or other official document)

Course Description

Tracer Kinetics studies the most common characteristics of distribution of various tracers in the human body during diagnostic or therapeutic procedures. Together with the courses of the program this course is aimed at studying engineering maintenance of medical equipment and physical principles of diagnosis.

The course makes a full cycle on fundamental training in the field of mathematical and physical foundations of medical diagnostics. In addition, it is necessary for the research work of students towards the master's program. Specialist of any profile, preparation of the general theoretical base for applied and profiling disciplines.

Course Aims

- To help students to systematize and repeat their level of mathematical modelling, which is the important part for the major topics of the course

- To educate students in fundamental laws of the distribution of tracers in the human body, depending on the type of substance and target organ
- To make students be able to apply mathematical methods and computational technique for calculating concentrations of substances
- To teach students the techniques and methods of solving specific practical tasks from various medical regions diagnostics using labels

Learning Outcomes of the Course

By the end of the course, the students will be able to:

- select an optimal kind of the radiopharmaceutical for the given region of interest
- compare the tracer concentration outputs taken in different organs
- construct the mathematical representation of the tracer distribution process in the given conditions
- determine the main characteristics of the tracer distribution

Course (module) Structure

Learning Activities	Hours
Lectures	4
Practice sessions / Seminars,	14
Self-study Assignments	54
Final Exam (including preparation)	-
Total study hours	**72**

Course Outline

Week	The title of the course subsection	Practice session / Assignments	Hours
1-8	Basics of the tracer kinetics	• Tracer types • Mathematical representation of the tracer data • Regression Analysis	

		• Non-compartment models • Compartment models • Evaluation of the kinetic parameters on the time-series • Spatial tracer distribution • Optimization of the tracer kinetics models • Mathematical optimization methods • Home assignment No 1	(3/7/28)
9-18	Main models of the tracer kinetics in the medicine	• Chossing the medical tracer • Graphical analysis of the medical tracer • The solution of the tracer kinetics problems for one and several parameters • Estimation of the tracer required dose of FDG for the target organ • The tarcer-tracee problem for FDG • Home assignment No 2	(1/7/26)

Course Instructors and Tutors, Contact Information

Instructor	Contact Information
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Assessment

Both midterm and final exams are in the form of a simulated experimental dataset. Problems for solution must be made with any suitable package: Matlab, Scilab, R etc.

Grade policy:

A (excellent work) B (above average work)	91-100 % 81-90 %

C (average work) D (below average work) F (failed work)	71-80 % 50-70 % <50 %

Core reading

1. E. D. MORRIS, C. J. ENDRES, K. C. SCHMIDT, B. T. CHRISTIAN, R. F. M. JR., and R. E. FISHER, “Chapter 23 - Kinetic Modeling in Positron Emission Tomography,” in Emission Tomography (M. N. Wernick and J. N. Aarsvold, eds.), pp. 499 – 540, San Diego: Academic Press, 2004

2. J. Delforge, A. Syrota, and B.M.Mazoyer, “Experimental design optimisation: theory and application to estimation of receptor model parameters using dynamic positron emission tomography,” Physics in Medicine & Biology, vol. 34, no. 4, pp. 419–435, 1989

3. V. J. Cunningham, S. P. Hume, G. R. Price, R. G. Ahier, J. E. Cremer, and A. K. P. Jones, “Compartmental analysis of diprenorphine binding to opiate receptors in the rat in vivo and its comparison with equilibrium data in vitro,” Journal of Cerebral Blood Flow & Metabolism, vol. 11, no. 1, pp. 1–9, 1991 PMID: 1845764