Basic Kinetic Modeling in PET and MR Imaging

February 24-28, 2020

Teachers

(GMK) Gitte Moos Knudsen, professor, MD, Neurobiology Research Unit, Rigshospitalet (course director)
(AEH) Adam Espe Hansen, MSc, PhD, Dept Nucl Medicine, Rigshospitalet
(KK) Karen Kettless, MRI Applications Specialist, Siemens Healthineers
(SC) Stig Præstekjær Cramer, MD, PhD, Functional Imaging Unit, Rigshopitalet Glostrup
(AL) Adriaan Lammertsma, Professor, VU University Medical Center, Amsterdam, The Netherlands
(IL) Ian Law, MD, DMSc, Dept. Clinical Physiology, Rigshospitalet
(UL) Ulrich Lindberg, MSc, PhD, Functional Imaging Unit, Rigshospitalet Glostrup
(LM) Lisbeth Marner, MD, DMSc, Dept. Clinical Physiology/Nuclear Medicine, Bispebjerg Hospital
(ETP) Esben Thade Petersen, MSc, PhD, MR Department, Hvidovre Hospital
(MS) Martin Schain, MSc, PhD, Neurobiology Research Unit, Rigshospitalet
(PS) Pontus Plavén-Sigray, PhD, Neurobiology Research Unit, Rigshospitalet
(CS) Claus Svarer, PhD, Neurobiology Research Unit, Rigshospitalet
(MV) Mark Vestergaard, MSc, PhD, Functional Imaging Unit, Rigshospitalet Glostrup

Location

Rigshospitalet, the Rockefeller building, entrance 69, 1st floor, Juliane Maries Vej 28, DK-2100 Copenhagen Ø.

Monday, Feb 24, 2020

09.00-9.30	Introduction (GMK, CS) Presentation of the individual participants. Please prepare a short presentation of yourself and the relation of tracer kinetics to your project.
9.30-10.00	Basic mathematics (CS)
10.00-10.30	***Coffee break***
10.30-12.00	Basic tracer kinetic concepts: Steady state, linearity, stationarity etc. (UL)
12.00-13.00	***Lunch***
13.00-14.00	Clearance, extraction, Renkin-Crone model (UL) Fick's principle (UL)
14.00-15.00	PC exercise 1 (intro, basics) (CS, GMK, MS, PS)
15.00-16.00	Determination of permeability, capillary heterogeneity (GMK) Modeling biological systems (GMK)

Tuesday, Feb 25, 2020

09.00-10.00	Bolus injection (SC)
10.00-11.00	Impulse response, convolution (SC)
11.00-12.00	Mean transit time, external residue detection (SC)
12.00-13.00	***Lunch***

Tuesday, Feb 25, 2020 (continued)

13.00-14.00	System theory (MV)
14.00-15.00	PC exercise 2 (convolution, extraction) (CS, GMK, PS)
15.00-16.00	Kety-Schmidt (MV)

Wednesday, Feb 26, 2020

09.00-09.45	Introduction to positron emission tomography (PET) and single photon emission tomography (SPECT) (MS)
09.45-10.30	PET and SPECT kinetics (MS)
10.30-10.45	***Coffee break***
10.45-12.00	Receptor kinetics (MS)
12.00-13.00	***Lunch***
13.00-14.00	Why modelling is important – the need for quantification (AL)
14.00-15.00	Determination of glucose consumption, deoxyglucose method (LM)
15.00-16.00	PC exercise 3 (models and rate constants) (GMK, CS, LM, MS, PS)

Thursday, Feb 27, 2020

09.00-10.00	Testing new radioligands (GMK)
10.00-11.00	Reference tissue modeling (CS, LM)
11.00-12.00	PC exercise 4 (linearization and reference tissue modeling) (CS, GMK, LM, PS)
12.00-13.00	***Lunch***
13:00-14:00	Introduction to magnetic resonance imaging (MRI) (AEH)
14:00-15:00	Measurements of heart perfusion using dynamic contrast enhancement and T1 weighted MRI (UL)
15.00-16.00	Measuring brain perfusion with Dynamic Susceptibility Contrast MRI (AEH)
16.00-17.00	PC exercises (MR) (AEH, CS)

Visit to the PET department in order to see the local setup for e.g. blood sampling, PET, and new combined PET/MR scanner.

Friday, Feb 28, 2020

09.00-10.00	Blood flow measurements using MR Arterial Spin Labelling (ETP)
10:00-11:00	MR measurements and kinetic modelling in kidney/liver/heart (KK)
11.00-12.00	Measurement and estimation of flow in brain, heart, liver, muscles, and kidneys using H2O PET techniques (IL)
12.00-12.30	PC exercise 5 (guess a model and wrap-up) (CS, GMK)
12.30-13.00	***Lunch***
13.00-14.00	Example of analysis and kinetic modeling of a dynamic brain PET dataset using standard software like PVElab and PMOD (CS)
14.00-14.30	Discussion of the course participants own projects, repetition, questions in groups (GMK, CS)