Rigshospitalet

DET SUNDHEDSVIDENSKABELIGE FAKULTET
KØBENHAVNS UNIVERSITET

Basic Kinetic Modeling in PET and MR Imaging

March 3-7, 2025

Teachers

(GMK) Gitte Moos Knudsen, professor, DMSc, Neurobiology Research Unit, Rigshospitalet (course director)
(HL) Henrik B.W. Larsson, professor, DMSc, Functional and Diagnostic MR Unit, Rigshospitalet (course Director)
(SC) Stig Præstekjær Cramer, MD, PhD, Functional Imaging Unit, Rigshopitalet Glostrup
(AEH) Adam Espe Hansen, Professor, MSc, PhD, Dept Diagnostic Radiology, Rigshospitalet
(AJ) Annette Johansen, MD, PhD, Neurobiology Research Unit, Rigshospitalet
(IL) Ian Law, Professor, DMSc, Dept. Clinical Physiology, Rigshospitalet
(UL) Ulrich Lindberg, MSc, PhD, Functional Imaging Unit, Rigshospitalet Glostrup
(CM) Clara Madsen, PhD student, Neurobiology Research Unit, Rigshospitalet
(LM) Lisbeth Marner, DMSc, Dept. Nuclear Medicine, Herlev and Gentofte Hospital
(MS) Martin Schain, MSc, PhD, Antaros Medical
(CS) Claus Svarer, PhD, Neurobiology Research Unit, Rigshospitalet
(MV) Mark Vestergaard, MSc, PhD, Functional Imaging Unit, Rigshospitalet Glostrup

Location

Neurobiology Research Unit, Rigshospitalet, entrance 7-8, Inge Lehmanns Vej 6-8, DK-2100 Copenhagen Ø
Monday, Tuesday, Wednesday&Thursday afternoon: NRU conference room, entrance 8, 5th floor.
Wednesday&Thursday morning, Friday: Ground floor, room 12.00.8523, located between entrance 7 and 8.

Monday, March 3, 2025

09.00-9.30	Introduction (GMK, CS, HL) 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, exponentials, compartment modelling and differential equations (CS)
10.00-10.30	Basic physiology, blood, tissue and Blood Brain Barrier (GMK)
10.30-11.00	***Coffee break***
11.00-12.30	Basic tracer kinetic concepts: Steady state, linearity, stationarity etc. (MV)
12.30-13.30	***Lunch***
13.30-14.30	Clearance and Fick's principle, including examples (SC)
14.30-15.30	PC exercise 1 (intro, basics) (CS, GMK, AJ)
15.30-16.30	Extraction, Renkin-Crone model, examples of determination of permeability (SC)

Tuesday, March 4, 2025

09.00-10.00	Bolus injection (HL)
10.00-11.00	Impulse response, convolution (HL)
11.00-12.00	Mean transit time, external residue detection (HL)
12.00-13.00	***Lunch***
13.00-14.00	System theory (HL)
14.00-15.00	PC exercise 2 (convolution, extraction) (CS, GMK, AJ)
15.00-16.00	System theory - continued (HL)

Wednesday, March 5, 2025

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	Testing new radioligands and pharmacology development (GMK)
14.00-15.00	Determination of glucose consumption, deoxyglucose method (LM)
15.00-16.00	PC exercise 3 (models and rate constants) (CS, LM, AJ)

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

Thursday, March 6, 2025

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

Friday, March 7, 2025

09.00-09.45	Perfusion measurements in brain using [^{15}O]-H_2O PET techniques and clinical applications (IL)
09.45-10.30	Measurements of tissue perfusion using [^{15}O]-H_2O PET - kinetic models of heart, kidney and liver. (LM)
10.30-10.45	***Coffee break***
10:45-11:30	Blood flow measurements using MR Arterial Spin Labelling (UL)
11.30-12.15	Animal imaging (CM)
12.15-12.45	PC exercise 5 (guess a model and wrap-up) (CS, GMK, LM, AJ)
12.45-13.15	***Lunch***
13.15-14.00	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 - bring material from your own project that you want to share and discuss (GMK, CS, HL)
14.30-15.00	Plenum discussion of course material (HL, CS, GMK)