

Title: Application of molecular biology and molecular brain imaging techniques in neurodegenerative disorders

Course number: 2315

Credits: 3.0

Date: 20160509 - 20160520

Language: English

Level: Doctoral level

Responsible KI department: Department of Neurobiology, Care Sciences and Society

Specific entry requirements: No

Learning outcomes: After the course the students will understand the main pathophysiological features of neurodegenerative diseases, with a focus on dementia disorders. After the course a doctoral student shall be able to:

- Account for recent advances in CSF and in vivo brain imaging biomarkers
- Account for the theoretical basis of main techniques used in molecular imaging and biochemical analyses used on living subjects and biological materials
- Develop, evaluate and validate in vivo brain and CSF markers
- Perform key in vitro and in vivo techniques
- Collect, process, analyze and interpret data of key techniques
- Apply what they have learned to their own research work

Contents of the course: This course will focus on scientific approaches used to study neurodegenerative disorders. Topics for the practical experiments will include the following: demonstrations of molecular imaging techniques that are used to study function and pathological changes in the brain of living patients/animal models including PET/microPET, demonstrations of MRI techniques for structural brain analysis, histopathological examination of brain lesions in human postmortem brain tissue and autoradiography and radioligand binding techniques to study localization of receptors, binding potential, changes in neurotransmitter function and to correlate these with other pathological changes in the brain, quantitative assays of biomarkers and proteins involved in signaling pathways in biological fluids and in the brain using brain homogenate, human CSF and/or plasma etc. The course will also discuss, provide a deep understanding, some hands-on training on how to setup and use common in-house sensitive assays, their advantages, applicability and caveats.

Teaching and learning activities: The course is full time (10 days) and will be organised as an integration of lectures, combined with practical exercises, demonstrations and literature studies.

Examination: All the intended learning outcomes will be assessed by a combination of written examination, written reports for the practical workshops, and oral presentation.

Compulsory elements: All parts of the course are mandatory. Absence from any of these will be compensated for by extra individual assignments provided by the course organizers.

Number of students: 10 - 20

Selection of students: Selection will be based on 1) the relevance of the course syllabus for the applicant's doctoral project (according to written motivation), 2) date for registration as a doctoral student (priority given to earlier registration date)

More information:

Course responsible: Taher Darreh-Shori

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Application of molecular biology and molecular imaging techniques in neurodegenerative disorders (course 2315)

May 9th to May 20th, 2016: WEEK 1

Monday (9/5)	Tuesday (10/5)	Wednesday (11/5)	Thursday (12/5)	Friday (13/5)
<p>9:00 - 10:00 Lecture Introduction to neurodegenerative disorders: focus on AD and other dementia disorders <i>Agneta Nordberg, KI</i></p>	<p>9:00 - 10:00 Lecture Magnetic resonance imaging (MRI) physics <i>Farshad Falahati, KI</i></p>	<p>9:00 - 10:00 Lecture Introduction to PET imaging and radiotracer development <i>Bengt Långström, Uppsala U.</i></p>	<p>9:00 - 10:00 Lecture Principles of quantification and parametric imaging of PET data <i>Zsolt Cselenyi, KI</i></p>	<p>9:00 - 10:00 Lecture PET imaging: focus on microPET <i>Miklós Tóth, KI</i></p>
<p>10:00 - 11:00 Lecture Neuropathology of neurodegenerative diseases <i>Irina Alafuzoff, Uppsala U.</i></p>	<p>10:00 - 11:00 Lecture Visual rating scales: clinical diagnosis and research <i>Daniel Ferreira, KI</i></p>	<p>10:00 - 11:00 Lecture Molecular PET imaging in Alzheimer's disease and related dementia disorders in a clinical perspective <i>Agneta Nordberg, KI</i></p>	<p>10:00 - 11:00 Lecture PET imaging analysis: Practical procedures <i>Laure Saint-Aubert, KI</i></p>	<p>10:00 - 10:45 Lecture/Discussion Application of microPET imaging in various animal models <i>Laetitia Lemoine, KI</i></p>
<p>11:00 - 12:00 Lecture Neuropathology of neurodegenerative diseases (cont'd) <i>Irina Alafuzoff, Uppsala U.</i></p>	<p>11:00 - 12:00 Lecture Voxel-based morphometry (VBM): Theory and applications <i>Joana Pereira, KI</i></p>	<p>11:00 - 12:00 Lecture Principles of PET imaging methodology and semi-quantitative approaches <i>Akihiro Takano, KI</i></p>	<p>11:00 - 12:00 Study time</p>	<p>11:00 - 12:00 Lecture MicroPET image analysis in AD mouse model: Introduction to practical workshop <i>Elena Rodriguez-Vieitez, KI</i></p>
<p>12:00 - 13:00 LUNCH</p>	<p>12:00 - 13:00 LUNCH</p>	<p>12:00 - 13:00 LUNCH</p>	<p>12:00 - 13:00 LUNCH</p>	<p>12:00 - 13:00 LUNCH</p>
<p>13:00 - 14:00 Lecture Functional and pathological correlates of subjective memory complaints in Aging and Alzheimer's disease <i>Patrizia Vannini, Brigham and Women's Hospital, Boston, USA</i></p>	<p>13:00 - 14:00 Lecture Introduction to MRI practical workshops: MRI sequences, <i>Farshad Falahati</i> Visual rating scales for brain atrophy and white matter lesions, <i>Daniel Ferreira</i> VBM analysis, <i>Joana Pereira</i></p>	<p>13:00 - 14:00 Study time</p>	<p>13:00 - 14:00 Lecture Introduction to PET practical workshop <i>Laure Saint-Aubert / Antoine Leuzy / Konstantinos Chiotis / Elena Rodriguez-Vieitez, KI</i></p>	<p>13:00 - 14:00 Lecture CSF and PET imaging biomarkers in preclinical and prodromal Alzheimer's disease <i>Oskar Hansson, Lund U.</i></p>
<p>14:00 - 14:15 COFFEE</p>				
<p>14:15 - 14:45</p>	<p>14:00 - 17:00</p>	<p>14:00 - 16:00</p>	<p>14:00 - 17:00</p>	<p>14:00 - 17:00</p>
<p>Introduction to task assignment</p>	<p>Imaging workshop: MRI Computer lab, Huddinge library, Room S311</p>	<p>Lectures: 14:00 - 14:40 Comparing CSF and amyloid PET biomarkers in AD <i>Antoine Leuzy, KI</i> 14:40 - 15:20 Tau PET imaging in prodromal and dementia stages of AD <i>Konstantinos Chiotis, KI</i> 15:20 - 16:00 Using the early frames of PET tracers as a proxy for brain perfusion <i>Elena Rodriguez-Vieitez, KI</i></p>	<p>Imaging workshop: PET Computer lab, Huddinge library, Room S311 <i>Laure Saint-Aubert / Antoine Leuzy / Konstantinos Chiotis / Elena Rodriguez-Vieitez, KI</i> <i>Div. Translational Alzheimer Neurobiology, KI</i></p>	<p>Imaging workshop: MicroPET Computer lab, Huddinge library, Room S311 <i>Laetitia Lemoine / Elena Rodriguez-Vieitez, KI</i> <i>Div. Translational Alzheimer Neurobiology, KI</i></p>
<p>14:45 - 15:30 Lecture Clinical assessment of dementia, <i>Vesna Jelic, KI</i></p>	<p><i>Joana Pereira / Daniel Ferreira / Farshad Falahati, KI</i> <i>Div. Clinical Geriatrics, KI</i></p>	<p>16:00 - 17:00 Visit to PET scanners, Huddinge Hospital, <i>Irina Savitcheva</i></p>		

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May 9th to May 20th, 2016: WEEK 2

Monday (16/5)	Tuesday (17/5)	Wednesday (18/5)	Thursday (19/5)	Friday (20/5)
<p>9:00 - 11:00 Lecture: In vitro molecular imaging techniques and their application in studies of neurodegenerative diseases</p> <p><i>Per-Göran Gillberg, KI</i></p>	<p>9:00 - 10:00 Lecture and Overview of Lab- Tracer development and overview of in vitro screening techniques (EA, SPA, ITC)</p> <p><i>Taher Darreh-Shori, KI</i></p>	<p>9:00 - 12:00 Lab: Enzymological analyses and IC50 and/or Ki calculation of the Lead</p> <p><i>Taher Darreh-Shori, KI Rajnish Kumar, KI Erica Lana, KI</i></p>	<p>9:00 - 10:30 Overview of Lab-workshop: Lab: Laboratory on in vitro imaging studies in postmortem brain</p> <p><i>Laetitia Lemoine, KI Lakshman Puli, KI</i></p>	<p>9:00 - 12:00 Own study time Preparation of oral exam and written lab report</p>
<p>11:00 - 12:00 Lecture: Fundamentals on astroglipathology: from astrodegeneration to astroglial reactivity</p> <p><i>Prof. Alexei Verkhratsky, Faculty of Life Sciences, University of Manchester, UK</i></p>	<p>10:00 - 12:00 Lab: Hits screening by enzymological analyses</p> <p><i>Taher Darreh-Shori, KI Rajnish Kumar, KI Erica Lana, KI</i></p>		<p>10:30 - 12:00 Demonstration: Autoradiography technique</p> <p><i>Laetitia Lemoine, KI Lakshman Puli, KI</i></p>	
<p>12:00 - 13:00 LUNCH</p>	<p>12:00 - 13:00 LUNCH</p>	<p>12:00 - 13:00 LUNCH</p>	<p>12:00 - 13:00 LUNCH</p>	<p>12:00 - 13:00 LUNCH</p>
<p>13:00 - 14:00 Lecture: Tracer development Computer-aided hits identification</p> <p><i>Rajnish Kumar, KI</i></p>	<p>13:00 - 14:00 Lab: Hits screening by enzymological analyses</p>	<p>13:00 - 14:00 Lab: IC50 and/or Ki calculation of the Lead</p>	<p>13:00 - 15:00 Tutorial on lamination</p> <p><i>Laetitia Lemoine, KI Lakshman Puli, KI</i></p>	<p>13:00 - 16:00 EXAM</p>
<p>14:00 - 14:15 COFFEE</p>	<p>14:00 - 14:15 COFFEE</p>	<p>14:00 - 14:15 COFFEE</p>	<p>14:00 - 14:15 COFFEE</p>	
<p>14:15 - 15:00 Lecture: Impact of epigenetic variation in the study of neurodegenerative disorders</p> <p><i>Erica Lana, KI</i></p>	<p>14:15 - 15:30 Lab:</p>	<p>14:15 - 17:00 Lab:/Data analyses:</p>	<p>15:00 - 17:00 Demonstration: Immunohistochemistry technique</p>	
<p>15:00 - 16:45 Lecture: Radiation safety at the lab</p> <p><i>Annie Olsson, KI</i></p>	<p>15:30 - 16:45 Preparation of written lab report / Individual consultations</p> <p><i>Taher Darreh-Shori, KI Rajnish Kumar, KI Erica Lana, KI</i></p>	<p>16:45 - 17:00 Discussion</p> <p><i>Taher Darreh-Shori, KI Rajnish Kumar, KI Erica Lana, KI</i></p>	<p><i>Laetitia Lemoine, KI Lakshman Puli, KI</i></p>	<p>16:45 - 17:00</p>
<p>16:45 - 17:00</p>				<p>16:45 - 17:00</p>

CAKE AND COFFEE

Thursday (19/5)	
Group 1 & 2	
9:00 - 10:00	
Overview of workshop: Laboratory on in vitro binding studies in postmortem brain	
Laetitia Lemoine	
10:00-10:30	
introduction to autoradiography/immunostaining workflow	
10:30-12:00	
Tutorial on lamination analysis	
Laetitia Lemoine	Lakshman Puli
12:00 - 13:00	
13:00 - 15:00	13:00-15:00
demonstration of immunostaining technique Groupe 1	demonstration of autoradiography technique and binding assay Groupe 2
Lakshman Puli	Laetitia Lemoine
14:00 - 14:15 <i>COFFEE</i>	
15:00-17:00	15:00-17:00
demonstration of immunostaining technique Groupe 2	demonstration of autoradiography technique and binding assay Groupe 1
Lakshman Puli	Laetitia Lemoine
17:00-17:10	
Wrap up of the day	
Laetitia Lemoine	Lakshman Puli