Programme, PhD course, Advanced In-vivo Optical imaging techniques, 2020

Title: Advanced In-vivo Optical imaging techniques

Aim: To introduce advanced optical techniques for in vivo imaging and how these can be applied in research projects.

Learning outcomes: The students should be able to understand the basis of different techniques, to learn their pitfalls, disadvantages and advantages, and to plan research projects that include these techniques

Content:

Day 1:

(Victor Albeck Building)

9:15 - 9:30 Course introduction (Sebastian Frische)

9:30 - 10:15 Basic concepts of light and lasers (Keisuke Yonehara)

10:15 - 10:30 Coffee

10:30 - 11:15 Optical Intrinsic Signal Imaging: Principles and applications (Eugenio Guitérrez)

11:15 - 12:00 Laser Doppler blood flow imaging: Principles and applications (Nina Kerting Iversen)

12:00 - 12:45 Lunch

12:45 - 13:30 Two-photon in-vivo microscopy: Principles and applications (Sebastian Frische)

13:30 - 14:15 Optical Coherence Tomography: Principles and applications (Eugenio Guitérrez)

14:15 - 14:30 Coffee

14:30 - 15:15 In vivo fluorescence and bioluminescence imaging (IVIS): Principles and applications (Frederik Dagnæs Hansen)

15:15 - 16:00 Laser Speckle imaging: Principles and applications (Dr. Dmitry Postnov (via video-link from Boston University (Neurophotonics Center) / Harvard University (Martinos Imaging Center)) (via video-link)

Day 2:

8:15 - 10:00 : Introduction to preparation of animal for optical imaging (Victor Albeck Building) (Nina Kerting Iversen)

10:30 - 12:30: Laboratory practicals:

a) OCT-imaging and 2-photon in vivo imaging of intracranial blood flow in mice (CFIN facilities, Skejby)

b) laser-speckle imaging of blood flow Skou-building, 4th floor, Instructors Vladimir Matchkov / Christian Staehr / Rajkumar Rajanathan)

c) 2-photon imaging of genetically expressed Ca-indicator (Biomedicine West, Bld. 1182, room 214/Yonehara)

d) 2-photon imaging of lymph-node? (Biomedicine Skou/Degn)?

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Day 3:

8:15 - 10:00 Introduction to group work and assignment of group supervisor (Victor Albeck Building) (Sebastian Frische, Keisuke Yonehara, Vladimir Matchkov, Nina Kerting Inversen, Eugenio Guiterrez, Anete Dudele, Søren Egedal Degn)

The students will be divided into 3 groups of 3 students. The task of each group is to make a project-plan for a study employing one or more of the techniques introduced on the course. The plan should include a detailed description of the hypothesis to be tested and the experimental setup and include references as would be required for a grant-proposal to a major foundation. Each group will be assigned a supervisor among the teachers at the course. The project plan should be submitted 1 week before the last day of the course. Each group will in addition be responsible for evaluating one other groups research plan. The evaluation will be oral at the last day of the course based on a presentation of each groups research plan.

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Day 4:

(Victor Albeck Building) (project-focused talks, can be changed - please suggest new!)

9:15 - 9:45 Cerebral Capillary blood flow in Alzheimer mice studied by 2-photon in-vivo microscopy: (Eugenio Guitérrez)

9:45 - 10:15 Cerebral Capillary blood flow in stroke models studied by 2-photon in-vivo microscopy: (Nina Kerting Iversen)

10:15 - 10:45 2-photon in-vivo microscopy of cerebral capillary blood flow during brain edema in awake mice (Luca Bordoni)

10:45 - 11:00 Coffee

11:00 - 11:30 2-photon microscopy of periferal nerves (Anete Dudele)

11:30 - 12:15 In vivo microscopy of tissue repair in the kidney (Ina Schiessl)

12:15 - 13:00 Lunch

13:00 - 14:00 Clonal evolution in germinal centres studied by 2-photon in-vivo microscopy (Søren Egedal Degn)

14:00 - 14:15 Coffee

14:15 - 15:00 Neuro-vascular coupling changes in migraine accessed with Laser Speckle approach (Vladimir Matchkov / Christian Staehr)

15:00 - 15:45 Laser Speckle flow measurements are essential in the discussion about a location of main vascular resistance in mesenteric circulation (Vladimir Matchkov / Asger Maare Soendergaard)

Day 5:

(Victor Albeck Building) (Sebastian Frische, Keisuke Yonehara, Vladimir Matchkov, Nina Kerting Inversen Eugenio Guiterrez, Anete Dudele, Søren Egedal Degn)

10:15 - 11:15: Invited talk: an interesting out-side speaker, who will also participate in evaluation of project proposals from the group - please suggest names

11:15 - 12:15: Lunch

12:15 - 13:15: Evaluation of group 1 (20 min presentation, 40 min discussion)

13:15 - 14:15 Evaluation of group 2 (20 min presentation, 40 min discussion)

14:15 - 15:15 Evaluation of group 3 (20 min presentation, 40 min discussion)

15:15 - 16:15 Evaluation of group 4 (20 min presentation, 40 min discussion)

Coffee available during evaluations.

Not scheduled: Literature reading and home assignment (group work).

Recommended knowledge for participation (if any):

The student should have a background within the biomedical sciences or medicine. The student should have fundamental physiological and anatomical knowledge.

Language: English

Head of course: Sebastian Frische

Instructors: Sebastian Frische, Nina K. Iversen, Eugenio Gutiérrez, Keisuke Yonehara, Vladimir Matchkov, Anete Dudele. Frederik Dagnæs Hansen, Søren Egedal Degn, Luca Bordoni, Invited speaker: nn

Number of participants: 16 participants

Dates and times: 14, 15, 16 and 23. January. 6. of February (Note the interval between day 4 and 5, of which the first 10 days are available for group work with the obligatory written project,plan, and the remaining days are available for each group to prepare their presentation and their critical evaluation of another groups project plan)

Place: Institute of Clinical Medicine (Skejby) and Institute of Biomedicine (West)