IRTG 914 Basic Principles Seminar and Advanced Methods Course (Summer 2017)

Topic:

Multiphoton Microscopy – Functional Studies in Mouse Models

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Aim:
The aim of this practical course is to give a general introduction into the concepts of advanced imaging microscopy and compare the benefits and weakness of the different methods with each other. You will learn about the principle and benefits of multiphoton microscopy especially in the context of intravital imaging of various mouse models to better understand biological processes in an *in-vivo* environment in health and disease.

Abstract and Agenda:
In-vivo microscopy is a powerful method for studying several questions in general biology, physiology and pathophysiology. The method of multiphoton fluorescence microscopy has extended the reach of *in-vivo* microscopy, bringing high-resolution imaging deep into the tissues and organs of living animals. As compared to other *in-vivo* imaging techniques, multiphoton microscopy is uniquely capable of providing a window into cellular and subcellular processes in the context of the intact, functioning animal. In addition, the ability of simultaneous acquisition of multiple colours of fluorescence from the same sample as well as photo-manipulation capacities make *in-vivo* microscopy uniquely suitable for the characterization up to three parameters from the same volume, supporting powerful correlative analyses.

The first part of this course is a theoretical introduction into the topic. The general concept of fluorescence is recapitulated, followed by an introduction into confocal laser scanning microscopy (LSM) and a comparison to classical wide-field fluorescence imaging. Then the principle of the multiphoton effect is explained, followed by an introduction into the concept of multiphoton microscopic imaging and its benefits for deep tissue imaging especially in living animals. Finally, some examples of multiphoton intravital imaging are introduced in different mouse models.
The second part of this course is a practical workshop. It will take place at the multiphoton core imaging platform of the Walter-Brendel-Center at one of our multiphoton microscope systems for intravital imaging. We will work with some selected mouse models and you will learn how functional studies are carried out using multiphoton imaging.

Note: We recommend the following **pre-read as preparation for the course** (the paper can be downloaded under http://www.mdpi.com/1420-3049/17/4/4047In)
Ishikawa-Ankerhold HC, Ankerhold R, Drummen GP. (2012). Advanced fluorescence microscopy techniques--FRAP, FLIP, FLAP, FRET and FLIM. Molecules. 4, 4047-4132. Review.