Summer Lectures 2026 | IRTG 1450 Multiscale Imaging

8 + 9 June 2026 | Multiscale Imaging Centre, Röntgenstraße 16, seminar rooms B+C

Monday, 8 June 2026

Biochemistry & signaling

09:00-09:45 **Florencia Sánchez**

How can we precisely control cell signalling outside the complexity of living tissues? This lecture explores mimetic approaches that recreate key features of the cellular microenvironment to modulate signalling with high spatiotemporal precision. We will explore techniques such as microfabrication, light-controlled patterning, and mimetic membranes to create synthetic platforms that help uncover how signal presentation shapes cellular behaviour. These approaches can advance our understanding of fundamental signalling mechanisms and open new possibilities for engineering cell responses in biomedicine.

09:45-10:30 **Seraphine Wegner**

Light-controlled spatiotemporal regulation in cells**:** In this lecture, I will introduce the fundamental principles of optogenetics, a technology that enables the regulation of cellular processes with high spatiotemporal precision using different wavelengths of visible light. Through selected examples, I will illustrate how optogenetic tools are applied in cell biology, inflammation research, and biomedical contexts.

Coffee break

Label chemistry

11:00-11:45 **Andreas Faust**

In molecular imaging of whole organisms (“from mice to men”), radioactive labelling is mostly the method of choice. Different radionuclides like 11C, 18F or 68Ga, 99mTc and other radio metals are employed. We will have a closer look at their nature, their implementation in labelling procedures and strategies for nano- and antibodies as well as whole cells to visualize migration. We will see that a good radiotracer candidate should have high affinity to the target, and also a beneficial pharmacokinetic profile in a highly complex biologic environment.

11:45-12:30 **Cristian Strassert**

Understanding the nature of excited states involving molecular probes is crucial for the development of photo functional labels – we will explore the correlation between molecular structure, fluorescence, phosphorescence and non-radiative deactivation pathways by using simple tools based on well-known molecular orbitals and an expanded Jablonski diagram.

Lunch break (MIC foyer)

13:15-18:00 ***Tour de Münsterland***

Join us on a bike tour heading through the famous Rieselfelder to Bäcker´s Erdbeer- und Spargelhof, where we will enjoy a new sport and team event in the afternoon. Please bring your bike and comfortable shoes/sneakers.

Tuesday, 9 June 2026

Bioinformatics & modelling

09:15-10:00 **Benedikt Wirth**

In this lecture, we will study the basic principles of mathematical optimization in imaging problems. We will cover topics like their mathematical formulation, discuss their main difficulties, and present the most relevant theoretical results. Finally, we will introduce a survey on the computational algorithms for their numerical solution.

10:00-10:45 **Benjamin Risse**

A practical guide to high-dimensional data – Dimensionality reduction & autoencoder: Working with high-dimensional and complex data has become a challenge in biomedical research. Accessing this data in an intuitive and/or graphical way is therefore considered an important skill in applied data science research. In my presentation, I will introduce some general challenges of working with high dimensional data and present some practical solutions, which are widely applicable to many applications. In particular, I will present easy-to-use techniques to reduce the dimensions for visualisation purposes and also touch on state-of-the-art machine learning solutions such as auto-encoder for unsupervised representation learning. My goal is to provide a guide of how to tackle these techniques in applied research projects to harness high-dimensional data.

Coffee break

Innate immunity

11:15-12:00 **Noelia Alonso Gonzalez**

Macrophages are cells of the innate immune system that show a high plasticity and heterogeneity, with a big range of differentiation stages, which vary in the different tissues and under diverse inflammatory or infectious states. They participate in the resolution of inflammation through cytokine production, clearing of pathogens and the phagocytosis of apoptotic cells, which in addition triggers the production of pro-resolving molecules and growth factors, contributing to tissue repair. Some tissue resident macrophages, especially in the lymphoid tissues, also contribute to antigen presentation and crosstalk with the adaptive immune system. This extreme heterogeneity of macrophage populations and their variety of immune and trophic functions requires a deep understanding of their biology as well as their host tissue. In this presentation, the strategies to study tissue-resident macrophages and their organ-specific functions, as well as the importance of their sub tissue location, will be discussed.

12:00-12:45 **Jan Rossaint**

Neutrophils are among the main effector cells of the innate immune system and are at the forefront of the immune response to both infectious and sterile inflammatory stimuli in most tissues. However, neutrophil recruitment to various tissues and in response to different stimuli shows distinct tissue-specific characteristics. This proves the need for observations in the *in vivo* system. By use of intravital microscopy, the individual steps of leukocyte recruitment can be visualized and analysed in various peripheral organ tissue. This presentation will feature an introduction in imaging strategies to visualize leukocyte recruitment *in vivo* in the murine system.

Lunch break (MIC foyer)

Anatomy of infection

13:45-14:30 **Tim Lämmermann**

Spatiotemporal control of immune cell dynamics within tissues is critical for successful innate and adaptive immune responses. Homeostatic trafficking and coordinated infiltration into and within sites of inflammation and infection rely on signalling in response to extracellular cues that in turn controls a variety of intracellular protein networks regulating leukocyte motility, migration, chemotaxis, positioning, and cell-cell interaction. The lecture will introduce the major trafficking routes of immune cells in the body. Additionally, fundamental molecular pathways that steer the dynamics of immune cells in lymphoid and non-lymphoid tissues will be introduced, with a particular focus on chemokine and chemoattractant signalling and the regulation of the cytoskeleton, to understand how distinct immune cell types acquire specific trafficking patterns during health and disease.

14:30-15:15 **Petra Dersch**

Bacterial human pathogens trigger global changes in the innate immune system. This includes robust recruitment and reprogramming of phagocytes, particularly neutrophils, monocytes, and macrophages. This depends strongly on the infection dynamics, the direct (injection of bacterial effectors into neutrophils and macrophages) and indirect (e.g., via secreted toxins, or LPS-triggered cytokine secretion) interference by the bacteria, and the affected tissue or organ. To address bacteria-triggered immune modulation and correlate it with outcomes such as pathology, successful clearance, or persistent infection, we use technologies including single-cell RNA sequencing, spatial transcriptomics, and imaging techniques (laser-scanning confocal microscopy, electron microscopy, and intravital microscopy) on infected mouse tissues.