

The 2011 Imaging Cell Migration in 3D Discussion Forum

The Penridge Suite, 470 Bowes Road, London, N11 1NL, United Kingdom: 25th November 2011

This event is a discussion forum, focused on available optical imaging techniques for cell migration in three dimensions. Thus these imaging techniques have to fulfill the requirement of penetrating several layers of cells without a major loss in optical quality. However, such techniques at the same time have to keep the dosage low enough to not perturb the very aspects of the system under study. An additional aspect is the mining of often large amounts of acquired data to draw biologically meaningful conclusions. Participants will have a chance to explore these aspects of the live cell imaging with the experts during round table and panel discussions

Meeting Chair: Dr. Rainer Heintzmann, Friedrich-Schiller-Universität Jena, Germany

This event has CPD accreditation

On registration please submit your questions to the panel that will be asked by the chair on the day of the event

9:00 – 9:30 **Registration**

9:30 – 9:35 **Introduction by Meeting Coordinator: Dr Mickey Ramalho**, Euroscicon, London, UK

9:35 – 9:40 **Introduction by the Chair: Dr Rainer Heintzmann**
Institute of Physical Chemistry, Friedrich-Schiller-Universität Jena, Germany

9:40 – 10:00 **High Resolution Imaging in Deep Tissue**

Dr Rainer Heintzmann

Institute of Physical Chemistry, Friedrich-Schiller-Universität Jena, Germany

This talk will present an overview of techniques suited for imaging beyond a single layer of cells on a coverslip. Optical coherence tomography, holographic microscopy, confocal microscopy, spinning disk, multi-photon microscopy (with single or multiple foci) and selective plane illumination will be discussed and compared. Key features of those techniques will be mentioned along with performance estimators such as resolution, maximal penetration depth, phototoxicity and speed. Attempts of adaptive optics to counteract optical aberrations as well as controlled light exposure to control the light dosage will be mentioned. This general overview is meant to serve as a basis for discussions in the discussion groups.

10:00 – 10:20 **Imaging Cell Adhesions in 3D Matrices**

Dr Maddy Parsons

Kings College London, UK

Cell migration is a vital process involved in normal human development, wound healing and inflammatory responses. However, many pathological states such as cancer metastasis, developmental defects and healing abnormalities are as a result of a dysregulation in the control of cell motility. Research in our lab is directed towards understanding the molecular mechanisms that regulate adhesion, polarisation and migration in adherent cells in a number of different contexts. We use a number of state-of-the-art microscopy techniques to tackle these fundamental questions, and to allow us to analyse protein dynamics and interactions within intact cells in 3D environments. Unravelling the complex process of converting signals from the extracellular environment to drive changes in cell migration is important to understanding the basis of many different diseases.

10:20 – 10:40 **Imaging Cellular Invasion: Role of the Cell Surface Collagen Degrading Enzyme**

Dr Yoshifumi Itoh

Kennedy Institute of Rheumatology, Imperial College London, UK

ECM plays a major role to maintain the architecture of tissues, to provide survival signals and differentiation signals to cells, to provide growth factor pools and scaffoldings for migration. On the other hand, ECM is also a physical barrier for migrating cells in tissues and needs to be degraded in order for cells to migrate through. Because cells require ECM as scaffolding, degradation of the barrier ECM needs to occur specifically at the direction of the migration. To degrade ECM barrier, cells utilise proteinases, and one of the plasma membrane-bound metalloproteinase, membrane-type 1 matrix metalloproteinase (MT1-MMP) is thought to be a critical enzyme for this process. MT1-MMP is regulated at the multiple steps, but homodimerization is an essential step to degrade collagen on the cell surface. By imaging this dimerization event in live cells using fluorescence resonance energy transfer, we found that MT1-MMP activity is regulated spatiotemporal manner during invasion.

10:40 – 11:00 **Mid-morning Break**

11:00 – 11:20 ***In vivo* Imaging of Cell Migration in Zebrafish**

Dr Jana Koth

King's College London

Zebrafish are ideally suited for imaging cell migration in the living organism (in vivo). Their embryos and larvae are small, transparent, develop at room temperature without the need of special climate chambers and offer a wide range of genetic tools. In this talk, different examples of imaging migrating cell populations in zebrafish will be introduced and technical advice on in vivo imaging will be given. Furthermore, current challenges and limitations of in vivo imaging of cell migration in zebrafish will be discussed.

11:20 – 11:40 **Image Analysis in 2 and 3D**

Dr Ann Wheeler

Blizard Institute of Cell and Molecular Science, UK

Quantification of cell migration is an essential part of the cell biologist's toolbox. In this talk the theoretical and practical aspects of cell migration will be discussed using Macrophage migration as an example. Different techniques from use of transwell plates to imaging migration in animals will be discussed. How to use some of the image analysis tools which are available for analysing migration will be demonstrated and there will be a discussion of necessary assumptions that need to be made to quantify cell migration.

11:40 – 12:00 **Automatic 3D and 4D Tracking and Analysis of Cells and their Components.**

Dr Marius Messerli,

Bitplane (Part of the Andor Group)

3D and 4D segmentation and tracking of cells and intracellular structures like nuclei and vesicles is a challenging task for most automated image analysis systems. Inherent complexity of cells architecture and interactions between organelles restricts the extent of automated image analysis. The Imaris suite of dedicated modules for data visualisation and analysis is a powerful solution for challenging microscopy datasets. Imaris combines the capability to work with multi-gigabyte images with applications-specific modules for cell/developmental biology and neuroscience. By applying biologists' concept of cells, ImarisCell visualises intricate relationships between cell compartments and lets the user segment, track and analyse 3/4-dimensional cell images.

12:00 – 12:30 **Working Lunch**

Please collect your lunch and take it to your discussion table

12:30 – 15:05 **Discussion Groups (Sessions 1-7)**

- Round table discussion groups (20 minutes each) will be held throughout the afternoon
- The Experts will rotate so that all delegates will participate in all the discussion topics
- All delegates will also be allocated a session for visiting the exhibition stands
- Where appropriate delegates will be able to bring their samples to the discussions
- See end of agenda for description of discussion tables

15:05 – 16:05 **Question and Answer Session**

This session will include summing up of the discussion tables and questions submitted both prior to the meeting and throughout the day

16:05 – 16:15 **Chairman's Summing Up and Feedback Prize Draw**

Round-table Discussion Sessions:

High Resolution Imaging in Deep Tissue

Hosted by Rainer Heintzmann, who gained his Diploma in Physics at the University of Osnabrueck in 1996 and in 1999 Ph.D. in Physics from the University of Heidelberg, Germany. From 2000 to 2004, he worked as a scientist in the Max Planck Institute for Biophysical Chemistry in Goettingen, Germany. In addition to heading the Biological Nanoimaging Group at the Randall Division of Cell and Molecular Biophysics at King's College London, he also heads a research division at the Institute of Photonic Technology in Jena. As a Professor of Physical Chemistry he teaches and does research at the Friedrich Schiller University, Jena, Germany. His main research area is high-resolution fluorescence microscopy. He has contributed to the development of a number of microscopy imaging modes such as structured illumination and pointillism. He also has a strong interest in various areas of image processing and is the author of over 40 published journal papers in biomedical imaging.

Methods to Image Dynamic Adhesions in Cells in 3D Matrices

Hosted by Dr Maddy Parsons, who first became interested in cell adhesion signalling in 3D environments during her PhD studies within the Dept of Medicine at UCL (1996-1999). Her research uncovered a novel role for integrin receptors in controlling ECM deposition in response to external mechanical loads. She then moved onto her postdoctoral position at

Cancer Research UK (2000-2005) where she further developed her interests in using complex imaging techniques to analyse protein interactions and dynamics during cell adhesion and migration. She established her own lab at King's College London in 2005 following award of a Royal Society University Research Fellowship.

Analysis of Cellular Invasion in 3D Matrix: Imaging and Quantitation

Hosted by Dr Yoshifumi Itoh, a senior lecturer of Matrix Biology at The Kennedy Institute of Rheumatology Division, Imperial College London. His research group studies the mechanism of cellular invasion focusing on the proteinases that degrade extracellular matrix during invasion process in the context of rheumatoid arthritis and cancer. His PhD was carried out at The University of Kansas Medical Center in US (1991-1996), and he was then an assistant professor at The University of Tokyo in Japan (1997-2001). Currently he is also responsible for running live cell imaging lab at the Kennedy institute.

Technical Advice on *in vivo* Imaging in Zebrafish

Hosted by Dr Jana Koth, who completed her diploma in animal physiology and zoology at the Humboldt-University in Berlin, Germany in 2006. She undertook her PhD studies at the MRC Centre for Developmental Neurobiology and the Randall Division for Cell & Molecular Biophysics at King's College London from 2006-2010. For her project she developed *in vivo* imaging techniques to do long term time-lapse imaging and *in vivo* cell tracking of developing migrating muscle precursor cells. She is currently working as a post-doc in Simon M. Hughes lab in King's Randall Division where she did her degree.

How to Analyse Cell Migration in 2 and 3D

Hosted by Dr Ann Wheeler, who is currently employed as the Manager of the BICMS advanced light microscopy facility (BALM) and is PI of the imaging lab. Previously she has worked at The Scripps Research Institute analysing behaviour of microtubules in polarising cells. Her PhD was carried out in the Ludwig Institute of Cancer research at UCL where she investigated the role of Rho GTPases in macrophage migration.

Tracking cells, their organelles and filaments with ImarisCell and FilamentTracer

Hosted by Dr Marius Messerli, the founder of Bitplane and a key contributor to Imaris' development since its inception at ETH, Zurich in 1992. Following the acquisition of Bitplane by Andor Technology in December 2009, Marius took the position of Director of Software.

Keywords:

zebrafish, migration, fluorescence, confocal, timelapse, MT1-MMP, ECM degradation, invasion, homodimerization, Imaris, cell, filament, spine, tracking

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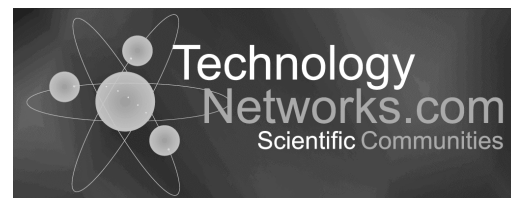


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Meeting Web Site: <http://www.regonline.co.uk/workshopLIVECELL2011>