3D imaging for Life Sciences

Programme for Thursday 19th April 2018, 19/3011, Highfield Campus, University of Southampton

Time	
9.00 – 9.30	Registration
9.30 – 10.00	Introduction to the Biomedical Imaging Unit and µ-VIS X-ray Imaging Centre. **Overview of imaging at the University of Southampton and in particular the two imaging core facilities.** Dr Anton Page & Dr Philipp Schneider
10.00 – 10.15	Technical presentation. **X-ray micro-CT as a tool for 3D x-ray histology.** Dr Orestis Katsamenis Microfocus x-ray computed tomography (µCT) is a powerful non-destructive 3D microscopy technique that is particularly popular in biomedical imaging. We recently demonstrated that, despite the general perception, the technique can be applied on routinely prepared wax-embedded histological specimens, in a clinical setting to assist diagnosis in fields of histopathology. We envisage that in the near future this technology will be readily available alongside conventional microscopy techniques, providing high resolution volume imaging and quantification capabilities that would improve accuracy of diagnosis.
10.15 – 10.30	Technical presentation. **Slicing biology by fluorescence.** Dr David Johnston Confocal and light sheet microscopy produce optical slices within three dimensional biological material, allowing 3D datasets to be generated. Both techniques can work simultaneously with multiple fluorescent labels, allowing multichannel / multi probe localisation studies.
10.30 – 11.00	Coffee
11.00 – 11.15	Application presentation. **Micro-CT for studying whole mouse embryos and lungs.** Dr Hans Michael Haitchi Micro CT is a powerful tool to study whole mouse embryos and mouse lung morphology. This session will cover how we used Micro CT to visualise the developing vascular tree in in a genetically modified mouse model. Furthermore it will cover different filling, fixation, contrast enhancing staining and analysis methods of the murine airways in wild-type and genetically engineered mouse models. Our asthma and lung research group is interested in the morphology of the developing and adult lung and its airways and in particular the airway remodelling in response to environmental factors (e.g. allergens) or genetic predisposition (e.g ADAM33) in mouse and human lungs.
11.15 – 11.30	Application presentation. **3D analysis of Retinal Pigment Epithelial cells: insights into the aged and diseased retina.** Dr Arjuna Ratnayaka Degeneration of the Retinal Pigment Epithelium (RPE), which maintains the overlying neuroretina, is a key event leading to irreversible sight loss. Although many structural and physiological changes associated with RPE dysfunction has been elucidated, it has not resulted in developing effective treatments against blinding retinopathies. Here, for the first time, we use serial block-face scanning electron microscopy (SBFSEM) to reconstruct the RPE in 3D. This has provided altogether new information on their structural organisation as well as insights into how some RPE cells may be particularly susceptible to disease.

11.30 – 11.45 Technical presentation. **High resolution 3D imaging by electron microscopy.** Dr Anton Page

An overview of serial block-face scanning electron microscopy (SBFSEM) and electron tomography (an extension of traditional transmission electron microscopy) which is facilitating imaging of tissues, cells and sub-cellular structure in three dimensions at the ultrastructural level.

11.45 – 12.00 Technical presentation. **Image processing & data management.** Drs Richard Boardman & David Chatelet

Datasets generated by digital imaging techniques, particularly 3D, can be large and cumbersome. Here we look at how these can be reduced to a more manageable size, and how they can and should be looked after once you have generated them.

12.15 – 13.15 Lunch

13.15 – 14.00 Key Note Presentation

Multiscale three dimensional imaging of the human placenta. Prof Rohan Lewis

Multiscale 3D imaging of the placenta is allowing us to identify novel structures at the tissue, cellular and subcellular level which could not be identified using traditional 2D imaging techniques. Furthermore, the 3D approach allows us to demonstrate the spatial relationships between different features which are allowing us to relate structure to function. The ability to visualise features and cellular spatial interrelationships that could not previously be visualised is leading to a new biological understanding of the placenta and may lead to novel biomarkers and therapeutic approaches.

14.00 – 14.20 Application presentation. **Correlative imaging of bone in 3D.** Patricia Goggin

Understanding the structure of osteocytes may help us to better understand how bone senses and responds to mechanical loads and how bone diseases develop. 3D images of the detailed structure of osteocytes and the bone around them would help to explain these mechanisms. This project aims to develop a method combining light, X-ray and electron microscopy techniques to image osteocytes in fine detail and over large volumes.

14.20 – 14.40 Application presentation. **3D correlative imaging of soft tissue and digital signal processing using micro-focus X-ray computed tomography.** Mat Lawson, Stephanie Robinson & Harry Rossides

Research applications that utilise versatile imaging techniques to obtain accurate 3D structural and cellular detail in soft tissue and allow for virtual 3D manipulation of the resulting reconstructions.

14.40 – 15.10 Coffee and discussion

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