

Imaging and Microscopy

www.cambridgecancer.org.uk/research/coreresources/imaging_microscopy



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The Imaging and Microscopy Facility provides a state-of-the-art core service in advanced imaging techniques, as well as undertaking the research and development of new emerging imaging modes in the context of cancer research.

The facility's confocal microscopes are the equipment of choice to produce best-quality fluorescence images. The Nikon C1 Si can image up to 32-spectral channels simultaneously while Leica SP5 system is also equipped with the fast resonance scanner option, which allows acquisition at 8000Hz: especially useful for acquiring fast z-stacks. Three of our confocal systems are set-up with motorized xyz stages for multiple-point time-lapse experiments as well as for work with large biopsies in 3D or 4D. Also, for large fields and especially live cells, the parallel-scanning spinning-disc confocal system (Improvision) provides fast image acquisition at high sensitivity.

Several Nikon **wide-field systems** are available with temperature and CO₂-control as well as optical servo-focus control for studies of apoptosis and culture growth (>24 hours) of cancer cells. **Multi-photon imaging**, using a pulsed IR-laser ranging from 690-1080 nm, has the penetration necessary to observe mammalian embryos, thick biopsies or special physiological probes. **Fluorescence life-time (FLIM)** imaging yields information on the molecular micro-environment of a fluorescent molecule and is commonly used in combination with **fluorescence resonance energy transfer (FRET)** to probe the proximity of molecules at sub-resolution. An **iCys Cell Imaging Cytometer** allows high-throughput imaging of cells of interest in a scattergram and the screening of cellular events such as the cell cycle and apoptosis. Imaging software (e.g. MetaMorph, Volocity, ImageJ and MatLab) also allows researchers to extract comprehensible quantitative data and elucidate three-dimensional structures. MatLab scripts and Software Macros are developed in collaboration with CRI researchers.

Research and Development

Our research goal is to develop the diagnostic and research imaging tools of tomorrow. Current projects include advanced **non-linear imaging**, particularly the combination of multi-photon of fluorescence lifetime information with second harmonic imaging for tumour detection in live cells and biopsies. Non-linear imaging has increased depth penetration, which is useful for imaging large biopsies (in collaboration with David Tuveson's and Doug Winton's research groups, CRI). **Second harmonic generation (SHG)** imaging uses the specifically scattered signal from unstained collagen, for example in matrix gels, to demonstrate the formation of vessels from endothelial cells (in collaboration with Gillian Murphy's group, CRI). Part of our work (in collaboration with the University of Heidelberg, University of Utrecht and Nikon Instruments Europe BV) is funded through EUREKA-EU funds. The **Confocal 'Macroscope'** project includes the design of a novel lens system with an unprecedented ratio of resolving power to magnification. Designed by Brad Amos of the MRC Laboratory of Molecular Biology, Cambridge, the system will improve observation of whole mouse embryos or large tissue biopsies. Institute members will have access to the prototype system in mid-2008, before it becomes commercially available.

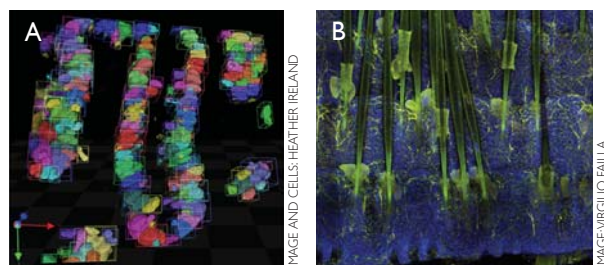


Image A: 3D reconstruction of a confocal z-series of a crypt in the murine small intestine expressing nuclear localised EYFP

Image B: SHG and auto-fluorescence image of mouse skin. Unstained collagen is blue, auto-fluorescence of hair follicles and blood vessels is green

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