

BEATSON ADVANCED IMAGING RESOURCE (BAIR)



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Light microscopy and flow cytometry allow us to gather information about important regulatory mechanisms in tumours and key cells of the microenvironment. These techniques allow us to simultaneously analyse large numbers of important molecules and cells with subcellular sensitivity and resolution in living samples whilst maintaining the context of the microenvironment, be that model substrate or living organism.

Beatson Advanced Imaging Resource (BAIR) scientists work closely with the Institute's researchers to uncover and interrogate important molecular pathways in cancer. The BAIR is thus involved at some stage in nearly every paper from researchers at the Institute that contains a light micrograph or a flow plot or uses sorted cells. We try to assist from experimental design right through to the finished figures. We train scientists in all stages of modern cytometric and microscopical research, from advice on sample preparation, basic and advanced microscope and cytometer operation and data acquisition through to quantitative image analysis and interpretation. At the start of a new project or application, we are keen to help researchers identify how our methods can be used to test key hypotheses and help them to design experiments that make the most of the resources we have. We also help to identify new technology and methodology that allow our researchers to take the most elegant approaches.

I can't believe it is already the third time we have had a BAIR imaging competition. Once again, an excellent field ranging from high-content to super-resolution. A difficult choice for all of our voters. This year Zeiss provided high-end binoculars for first prize, won by Nikki Paul! Some of the stunning pictures that exhibit the excellent imaging performed in the BAIR are showcased throughout the report.

Imaging across different spatial and biological complexity scales

We now have the expertise and instruments to:

- Address multiplexed panels of up to 15 markers in liquid phase and dissociated tissue

samples by flow cytometry and sort cell populations for downstream analysis (e.g. proteomics or transcriptomics using other advanced technology at the Institute)

- Perform automated liquid and plate handling for very high-throughput imaging experiments to analyse cell behaviour over thousands of experimental conditions via high-content imaging
- Image and spatially separate and quantitate up to seven markers in thick tissue including label-free approaches (e.g. second harmonic generation to look at fibrillar collagen) by combining tissue clearing, multiphoton excitation and spectral imaging
- Image cell behaviour over several days in tissue culture incubators
- Address the physicochemical environment of probes, molecular activity and signal transduction pathways below the diffraction limit at different spatiotemporal scales using FLIM, FRET and superresolution imaging
- Address cell function in living organisms via advanced intravital microscopy.

In this way, we hope to underpin cancer research at the Institute by allowing our researchers to work 'up and down the biological complexity scale', taking the best and most important aspects of different models and patient samples, and combining them into a larger more complete picture.

Publications listed on page 83

Lysosome trafficking by Nikki Paul, winner of the 2018 BAIR imaging competition. PDAC cell expressing GFP-ATP6V0D1 in lysosomes. Imaged every 1 minute for 30mins using Zeiss 880 LSM with Airyscan. Each frame coloured differently over time.

