Prostate and breast cancer are the second most common cancer killers of Australian men and women. Management of these cancers is hindered by the absence of imaging methods that can accurately describe the presence, the grade, and the extent of the disease.

The poor performance of current imaging methods can be attributed to their essentially indirect method of cancer detection - they measure structural or physiological parameters that are associated with cancer, rather than the microscopic tissue architectural features that define cancer.

We have proven the ability of diffusion MRI microscopy to shed light on current clinical prostate imaging mysteries, but the potential goes much further than this.

Cellular scale MRI microscopy can elucidate the critical microscopic tissue properties that will enable numerical simulation of the biophysical properties of normal prostate and breast tissue and the changes that occur with development of cancer.

Simulation of water diffusion in tissue, using models based on MRI microscopy measurements, will enable evidence-based development of new clinical imaging techniques that have significantly higher sensitivity and specificity for cancer detection and characterization than current empirically-developed methods.

We are taking a much more direct approach to cancer imaging.
RESULTS

Our diffusion MR microscopy technique achieves spatial resolution >2000 times higher than in any previously published studies of glandular tissue.

Comparison of relative voxel sizes obtained with DWI in vivo, in fixed whole organs, and in our MR microscopy system.

Surface-rendered diffusion-weighted volume image of normal prostate tissue clearly illustrates ductal structures (d) lined with secretory epithelia (e) embedded in the stromal matrix (s)...

... These features correspond directly with those seen on light microscopy of normal glandular prostate tissue.

DWI enables mapping of stromal fibers in a 3mm diameter tissue core. Colour indicates fiber direction.

NHMRC PROJECT GRANT

“Improving cancer management by direct detection with diffusion-weighted magnetic resonance imaging.”

CIs: Bourne, Price, Kurniawan, Cowin, Vegh, Stait-Gardner, Power.

$407,000 2012-14

PEER REVIEWED PUBLICATIONS


Contact Roger Bourne to enquire about:

- Research collaboration
- Postdoctoral and PhD opportunities
- Honours degree supervision

roger.bourne@sydney.edu.au

16.4 Tesla vertical bore system for MR microscopy of tissue