**A scalable actuator for the dynamic palpation of soft tissue for use in the assessment of prostate tissue quality**

P Scanlan1, S J Hammer1, D W Good2,3, W Shu1, R L Reuben1, S Phipps2,3, G D Stewart2,3, S A McNeill2,3

1Heriot Watt University, Edinburgh UK

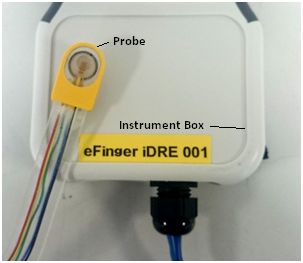
2Dept. of Urology Western General Hospital, Edinburgh UK

3Edinburgh Urological Cancer Group, Institute of Genetics and Molecular Medicine, University of Edinburgh, UK

We will report on a novel device for *in vivo* assessment of prostate tissue quality. Studies have shown a relationship between the histology of prostate tissue and elements of its complex modulus [1]. One of the first steps for *in* *vivo* assessment of prostate cancer is digital rectal examination (DRE), and our first aim is to instrument this procedure.

Previous work demonstrated *ex vivo* assessment using hydraulic palpation in which a controlled sinusoidal strain is applied over a range of actuation frequencies and the resulting force is used to obtain the dynamic elastic modulus, expressed as an amplitude ratio (|E\*|) and phase difference (tan δ). We have developed a scalable, micro-engineered device that can be applied *in vivo* using the same principles, but utilizing a vibrating silicone membrane with embedded strain gauges to apply the displacement and measure the force. The design of the device is such that it can be incorporated onto the end of a clinician’s finger and under a standard surgical glove where it can be actuated pneumatically at various frequencies.

Continuing on from our previous work and testing on *ex vivo* samples, we have now calibrated our probe against results obtained from a dead reckoning rig and carried out our first *in vivo* patient tests with along with comparison MRI scans and *ex vivo* measurements, the results of which are currently being analysed. Following on from this, and the results from further patient testing, we look to build a database of results which can be used with pattern recognition software to detect common tissue characteristics in correlation to specific tissue morphology. Miniaturisation of the device is also on-going with our smallest probe to date having been fabricated using our current process. We are currently looking in to graphene printing and photo-etching to create an even smaller more robust probe.



**REFERENCES**

1. **Phipps S,** *et al*. Measurement of tissue mechanical characteristics to distinguish between benign and malignant prostatic disease. Urology 2005;66(2):447-5