Low-cost engineered hydrogel biosensors detect miRNA biomarkers in blood: A new test for early diagnosis of prostate cancer

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“There is currently no screening programme for prostate cancer in the UK ... Instead of a national screening programme, there is an informed choice programme on prostate cancer risk management. It aims to give men good information on the pros and cons of a PSA test” (NHS website)

Prostate Cancer: Clinical and Economic Burden

- 35,000 new cases diagnosed per year in the UK alone
- 2nd most commonly diagnosed cancer among men
- $3 billion is the estimated yearly cost of overtreatment

Need

1) Highly specific and easily accessible biomarkers
2) Low-cost technology, compatible with widespread public screening

Aim

We aim to engineer and validate a new blood test for highly specific diagnosis of prostate cancer at an early stage. The test will be based on the ultrasensitive detection of cancer-specific miRNA biomarkers in a drop of a patient’s blood, using chemically engineered probes incorporated into low-cost portable devices.

Sensing Strategy

Two engineered peptide nucleic acid (PNA) probes are functionalised with non-fluorescent molecules. The target miRNA brings them together, allowing the molecules to react and produce a fluorescent signal.

Hydrogels from Algae: Roles and Advantages

1) low-cost, permeable biomaterial
2) separates miRNA from full blood (size-exclusion)
3) increases sensitivity compared to sensing in solution

Preliminary data show that hydrogels provide a practical, tailorable medium that enhances miRNA sensing in blood by improving sensitivity and limiting sample manipulation/processing. Future work includes simultaneous detection of multiple miRNA biomarkers for improved specificity and incorporation of probes into portable devices that can be used in a GP’s clinic.

References

2) Gavin Metcalf. Doctoral Researcher in Cancer Bioengineering (Imperial College London). Personal Communication. 10 February 2016