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Nanocytology for cancer diagnosis

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The hallmark of cancer is the invasive and metastatic nature of the disease. Cancer cell invasion and metastasis are driven by the altered cytoskeletal infrastructures that result from the complex interplay of activation/inactivation of multiple signaling pathways regulating these cellular events, which can occur at either the genetic or epigenetic level. Thus, attempts to accurately assess these physiologically relevant mechanical properties of cancer cells using single or even multiple marker profiles at the DNA, RNA or protein level have largely been unsuccessful. Recently we showed that cancer cell mechanical properties or mechanotypic biomarkers, including cell elasticity and deformability can be directly and accurately measured by state of the art label-free technologies at the single cell level. These mechanical properties of cells can be a marker for cancer cell behavior including invasion, metastasis and drug response. Our multi-disciplinary team of investigators developed an approach that combines morphology, molecular and mechanotypic profiling for cancer cell analysis, a process called "Nanocytology". The technologies we have developed and utilized include Atomic Force Microscopy (AFM), Deformability Cytometry (DC) and Parallel Microfiltration (PMF), which collectively enable robust and high throughput measurements and can potentially be implemented either in clinical setting (for detecting cancer cells) or for drug screen. The nanocytology approach has potential to bring cancer diagnosis and management to a new level to overcome some of the limitations of current morphological and molecular based analysis.

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Initiation of the pan-Manchester MCRC biobank: Key learning points

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Research biobanks are a vital resource in basic and translational cancer scientific research. This paper outlines the concept and successful delivery of a major biobank spanning a large industrial conurbation. The Manchester Cancer Research Centre (MCRC) has established a pan-Manchester biobank based at the Christie Cancer Centre and involving 4 other large teaching hospitals. Frozen and formalin fixed tumor and normal tissue with related blood and urine samples is collected from patients undergoing cancer surgery. Archives are also mined, particularly where these collections are linked to clinical outcomes. Fresh tumor samples and fluids are also collected prospectively for culture and in vivo work. Resource for the biobank has been obtained from various sources, both academic and commercial. Challenges faced when setting up a large cancer biobank are varied and complex and key learning points have been identified from the MCRC biobank experience. Things considered include; effective and early communication with collaborating NHS Trusts, timing of staff recruitment, development of Standard Operating Protocols to produce high quality samples and the need for an advanced database system to deal with both sample tracking and related informatics. Involvement of key clinical, scientific and managerial and support staff has been critical at each stage. Learning points from the development of the MCRC biobank may assist future cancer biobank developments to ensure a robust infrastructure supporting the collection of large numbers of high quality biological samples, which are easily accessible to researchers.

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