

Biosensing System and Method for In-situ Determination of Metastasis in a Sample



Health & Wellness

Biomedical and Genetic Engineering/Chemical Products

Opportunity

Cancer patients who develop secondary tumours (metastasis) often have a poor prognosis. Detecting metastatic disease early is vital to facilitate timely treatment and intervention and thereby reduce cancer mortality. However, such early detection remains challenging due to a lack of sensitive biomarkers and cost-effective approaches. Conventional diagnostic arrays require large and highly specialised equipment, and extracting tumour cells and DNA can be invasive and time-consuming. Furthermore, the heterogeneity of reads creates the need for extensive downstream processing and evaluation by trained personnel. To address these challenges, there is a need for an easy-to-use platform that is label-free, ultrasensitive, and designed for both point-of-care and personalised testing to monitor cancer patients' metastatic status. In particular, such a platform should be able to generate data that can be instantly and easily assessed optically by the patient and transferred from the patient to a practitioner without special skills or training.

Technology

The invention is a system that uses a microfluidic biosensor to detect metastasis in biological samples, specifically urine, in situ. The biosensing is performed using tiny worms known as *Caenorhabditis elegans* (*C. elegans*), due to their sensitive chemosensory properties. The system analyses the chemotactic behaviour of *C. elegans* in response to metabolites in urine samples, which are found in higher concentrations in metastatic breast cancer patients than in non-metastatic or healthy individuals. By observing how the worms react to the urine samples, the system can determine whether cancer has spread.

The system is designed for both point-of-care testing and home-based assessment. It can be integrated with portable imaging devices or even smartphones to capture and analyse the movement of *C. elegans*, allowing for real-time assessment of patients' metastatic status. This non-invasive approach offers a low-cost, efficient alternative to traditional diagnostic methods, facilitating remote testing and routine screening for cancer metastasis.

IP Status

Patent filed

Technology Readiness
Level (TRL) ?

3

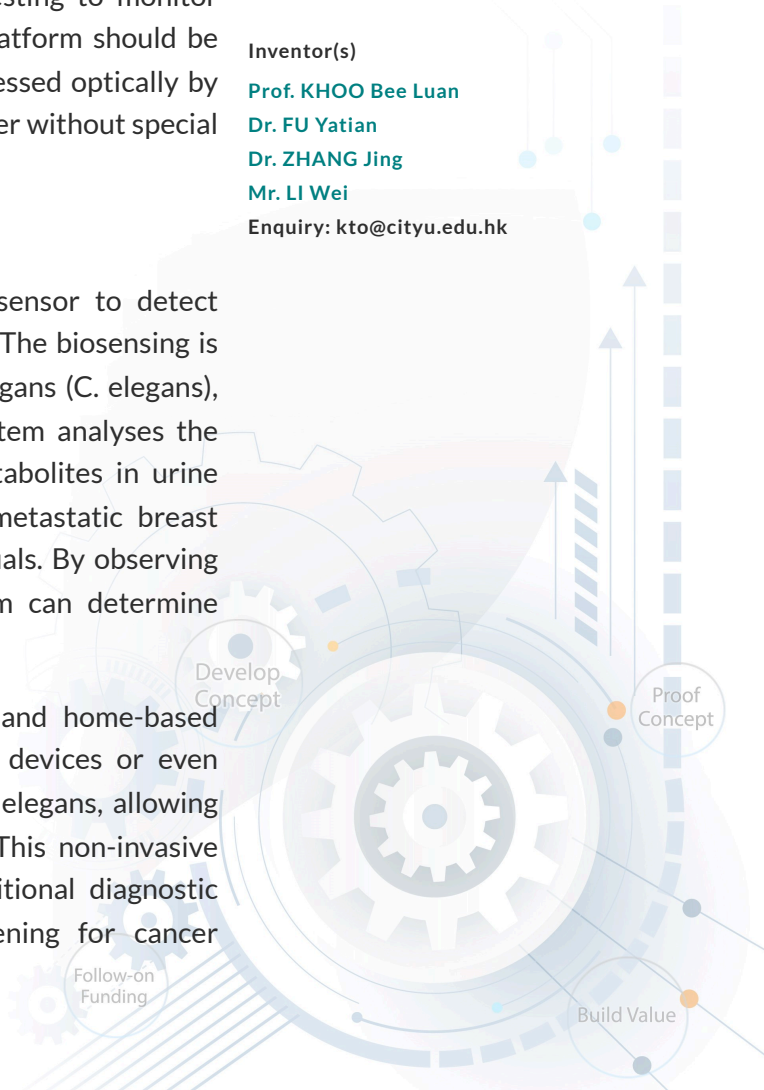
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Advantages

- Whereas conventional diagnostic techniques require large and specialised equipment, the requirements of the novel system are relatively low: a portable imaging device, smartphone or other mobile device integrated with a camera is sufficient to acquire the required data for subsequent analysis. This makes the novel system more cost-effective and efficient than existing techniques.
- Unlike conventional techniques, which often involve biopsies for cell/DNA extraction, the novel method is non-invasive.
- Conventional techniques require extensive downstream processing and evaluation by trained personnel, whereas the novel system enables real-time analysis, allowing for quicker decision-making on patient care and treatment options.
- The novel system has been shown to outperform gold standards for detecting metastatic breast cancer in terms of sensitivity.

Applications

- Cancer screening and routine monitoring at point of care (in clinics, hospitals)
- Home-based diagnostics (enabling patients to perform tests at home for convenience)
- Research tool for studying metastasis (laboratory settings)
- Personalised medicine

