

TECHNICAL RELEASE

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A*STAR IME HERALDS PERSONALISED THERAPY FOR CANCER PATIENTS WITH FASTER AND CHEAPER TEST

Researchers from A*STAR Institute of Microelectronics (IME) Bioelectronics programme are developing a cost-effective and a more rapid way to help physicians assess the effectiveness of treatments to cancer patients. IME's research will allow more frequent tracking of a patient's response to the prescribed treatment, enabling the physician to better tailor dosages for radiation and/or chemotherapy - treatments that can be plagued with discomfort and serious side effects. The new device measures the level of circulating tumour cells (CTCs) in whole blood and it is expected to speed up the sample-to-answer process by more than 50%.

"There is currently only one clinically approved method for CTC analysis worldwide, and it takes 3 – 7 days to process," said Associate Professor Richie Soong, Senior Principal Investigator, Cancer Science institute of Singapore at the National University of Singapore, who provided consultation to the IME team on test design requirements.

Circulating tumour cells (CTCs) are cells that have detached from a primary tumour and their circulation levels in the blood stream track the progression of cancer. The detection of CTCs is usually based on the presence of specific biomarker on their surfaces. To detect CTCs among a sea of red and white blood cells is like looking for a needle in a haystack. The current practice of measuring CTC uses a combination of complex magnetic forces and specific antibody-antigen interactions to isolate the CTCs. This is followed by laborious fluorescent tagging of the CTC before they can be detected and measured. All these labour-intensive steps add up to a substantial total analysis cost, on top of other medical expenses and long waiting time that the patient has to bear.

Imaging techniques and biopsies are other methods of cancer diagnosis. However, these methods require the tumour to reach a considerable size before the tumour can be detected, making these methods not favourable for early diagnosis. Using CTCs to flag the presence of a tumour earlier will also be less invasive than surgical biopsy methods.

Soong envisions IME's research endeavour will lower costs and speed up turnaround times for CTC analysis, allowing physicians to order the CTC test more frequently. This would facilitate a more informed and a faster decision making process, which promises better management and potentially improved outcomes for patients.

The IME approach uses antigen-coated magnetic beads to capture the CTCs. The captured CTCs on the magnetic beads are then isolated before the CTCs are directly detected on the specially-treated microelectrode array (MEA). This way, the level of CTC is inferred from the impedance reading obtained.

Dr Abdur Rub Abdur Rahman, Senior Research Engineer from IME's Bioelectronics Programme, said, "Our preliminary results showed that our device can detect 1 CTC directly from a pure cell standard – showing great promise as a sensitive test for cancer diagnosis. For breast cancer, the detection of 5 CTCs in 7.5 ml of whole blood was reported as a minimal disease state¹. Future work will entail full

¹ Cristofanilli M, Budd GT, Ellis MJ, et al, N Engl J Med (2004) 351:781–91

integration of the different modules, improving the total analysis time and boosting the sensitivity – vital steps to getting the system ready for clinical testing. Our aim is to go from sample to answer in less than a day and to cap the cost at \$100 per test. Comparatively, the clinically approved CTC method is priced at about USD \$650² (approximately SGD \$910). IME's CTC test can be further developed to provide genetic information of the detected cancer cells that will be an important starting point for drug discovery leading to personalised medicine.”

Cancer is rated the number 2 killer in Singapore. From 2002 - 2006, there were 42,424 incidents of cancer diagnosed among the residents of Singapore³.

About the Institute of Microelectronics (IME)

The Institute of Microelectronics (IME) is a research institute of the Science and Engineering Research Council of the Agency for Science, Technology and Research (A*STAR). Positioned to bridge the R&D between academia and industry, IME's mission is to add value to Singapore's semiconductor industry by developing strategic competencies, innovative technologies and intellectual property; enabling enterprises to be technologically competitive; and cultivating a technology talent pool to inject new knowledge to the industry. Its key research areas are in integrated circuits design, advanced packaging, bioelectronics and medical devices, MEMS, nanoelectronics, and photonics. For more information, visit IME on the Internet: <http://www.ime.a-star.edu.sg>.

About the Agency for Science, Technology and Research (A*STAR)

The Agency for Science, Technology and Research (A*STAR) is the lead agency for fostering world-class scientific research and talent for a vibrant knowledge-based and innovation-driven Singapore. A*STAR oversees 14 biomedical sciences, and physical sciences and engineering research institutes, and seven consortia & centre, which are located in Biopolis and Fusionopolis, as well as their immediate vicinity.

A*STAR supports Singapore's key economic clusters by providing intellectual, human and industrial capital to its partners in industry. It also supports extramural research in the universities, hospitals, research centres, and with other local and international partners.

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² Fischer AH, Archives of Pathology & Laboratory Medicine, (1999) 133: 1367 – 1369

³ “The Big C”, The Straits Times, 6 March 2010