

## TECHNICAL RELEASE

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### **FASTER TREATMENT OF HEART PATIENTS WITH A FINGER PRICK OF BLOOD: NEW BEDSIDE TOOL TO DETECT RARE ENDOTHELIAL PROGENITOR CELLS**

From sample to answer in just 1 hour with just a finger prick of blood is what researchers from A\*STAR Institute of Microelectronics (IME) aim to achieve with their novel microfluidic system for rapid and sensitive detection of rare circulating endothelial progenitor cells<sup>1</sup> (EPC). The microfluidic system can be used as a bedside tool for point-of-care diagnostics, which will assist clinicians to perform in-depth studies to uncover new potential health implications of EPC levels, to monitor the efficiency of drug therapy or to help cardiologists prescribe suitable treatments for heart patients with clogged arteries. Previously with conventional method known as flow cytometry, the level of EPC in blood can only be known after 4 – 5 hours, which may not be fast enough to treat acute cases. The new method is sensitive enough to detect 720 EPC, equivalent to a concentration of 0.1 % EPC in a volume of 100  $\mu$ l whole blood. In most population, the level of EPC in blood is low, as the EPC make up only 0.01 – 1% of peripheral blood mononuclear cells<sup>2</sup>.

The bedside detection tool is the result of collaboration between IME researchers and cardiologists. Associate Professor Philip Wong, Senior Consultant, Department of Cardiology and Director, Research and Development Unit, National Heart Centre Singapore (NHCS), who is involved in the collaboration, said, “This collaboration combines the merits of NHCS’s clinical expertise with IME’s bioengineering knowledge. NHCS clinician scientists are familiar with the clinical problem and the solution required as we are in direct contact with the patients. IME engineers, on the other hand, have the expertise to develop the solution. This is a distinct example on how our clinician scientists have ventured beyond the conventional boundaries of medicine to bring forth improvements in patient care, in this case, the use of EPC detection system to monitor the patient’s status of blood vessels in the clinic and their response to certain medicines.”

Describing how the EPC detection tool works, Dr Kao Tzu-Hsiang Linus, Senior Research Engineer of IME’s Bioelectronics Programme explained, “To achieve the detection of inherently low levels of EPC from just tens of microlitres of blood, our team has come up with a novel design to allow the blood sample to be directly loaded onto the microfluidic chamber to minimise cell loss. This is followed by the extraction of EPC from the complex cell mixture in blood using a combination of electrical forces and specific antibody-antigen chemistry to selectively capture the EPC onto the surfaces of the microelectrodes. The same microelectrodes used for cell trapping are subsequently transformed into cell detectors by a clever switch of voltage conditions, converting the captured EPC into a measurable electrical response. At present, we are working towards the realisation of a prototype to integrate the sample preparation and the detection modules. Once the prototype is ready, we will partner with our clinician collaborator to optimise our protocol

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<sup>1</sup> Endothelial progenitor cells (or EPC) are circulating stem cells from the bone marrow that are involved in vascular surfaces repair. The level of EPC in blood is a biomarker of clinical interest, linked to the assessment of risk factors in cardiovascular diseases.

<sup>2</sup> SY Ng, J Reboud, KYP Wang, KC Tang, L Zhang, P Wong, KT Moe, W Shim, Y Chen, 2010, Biosens. Bioelectron., 15, pp1095-1101

with blood samples from patients. Ultimately, our goal is to produce a test kit that is time efficient and easily available to physicians.”

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**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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**About the National Heart Centre Singapore (NHCS)**

The National Heart Centre Singapore (NHCS) is a 185-bed national and regional referral centre for cardiovascular diseases. A one-stop facility with the largest heart specialists group in Singapore, NHCS treats complex cases and sees the highest volume of heart patients locally.

Each year, the centre handles over 90,000 outpatient consultations, 6,000 interventional and surgical procedures and 9,000 inpatients. Its outcomes for heart attack treatment, balloon angioplasty with stenting and coronary bypass surgery have been shown to be equivalent to international standards.

NHCS is the first heart centre outside USA and in Asia to receive the prestigious Joint Commission International (JCI) since 2005, which is an assurance for safe and quality patient care for the patients.

For more information on NHCS, please visit [www.nhcs.com.sg](http://www.nhcs.com.sg).