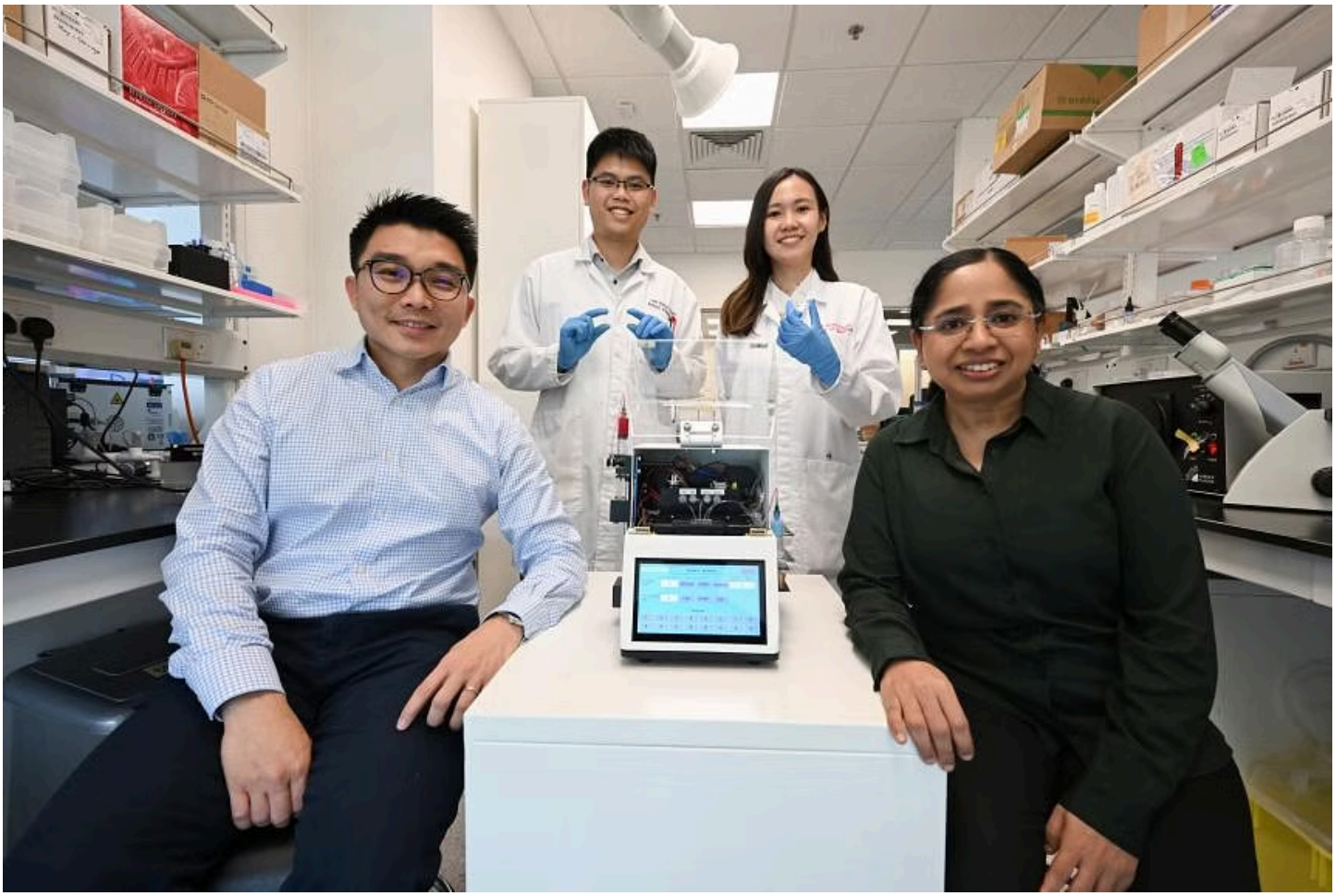
THE STRAITS TIMES

NTU develops potential 'game changer' for quick detection of cancers, diseases from blood samples



The NTU team consisting of (from left) Associate Professor Hou Han Wei, research fellow Leong Sheng Yuan and research engineer Lok Wan Wei, with TTSH's Associate Professor Rinkoo Dalan. ST PHOTO: SHINTARO TAY

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SINGAPORE – Scientists in Singapore have developed a new method of isolating blood plasma that will allow for certain cancers and diseases, such as non-small cell lung cancer and Type 2 diabetes, to be detected more quickly and accurately.

Developed by a team of scientists at Nanyang Technological University (NTU), this method involves the direct isolation of blood plasma from blood in just 30 minutes using a coin-sized chip.

Blood plasma is a rich source of information containing biomarkers which are measurable DNA, RNA or protein components that can indicate possible conditions or diseases such as cancer. Blood plasma is found in blood, which also consists of white blood cells, red blood cells and platelets.

The current method of isolating blood plasma by centrifugation involves multiple steps and can take up to an hour.

Even after two rounds of spinning in a centrifuge, some cells and platelets can still be found in the isolated blood plasma, which can degrade and lead to unwanted biological materials that can affect the accuracy of diagnostic tests used to screen for conditions and diseases.

Dubbed ExoArc, the patent-pending chip, measuring 3.5cm by 2.5cm and 0.3cm thick, has to be connected to a machine that pumps the blood sample into small tubes to create a high flow pressure which separates smaller biological materials from larger cells and unwanted materials.

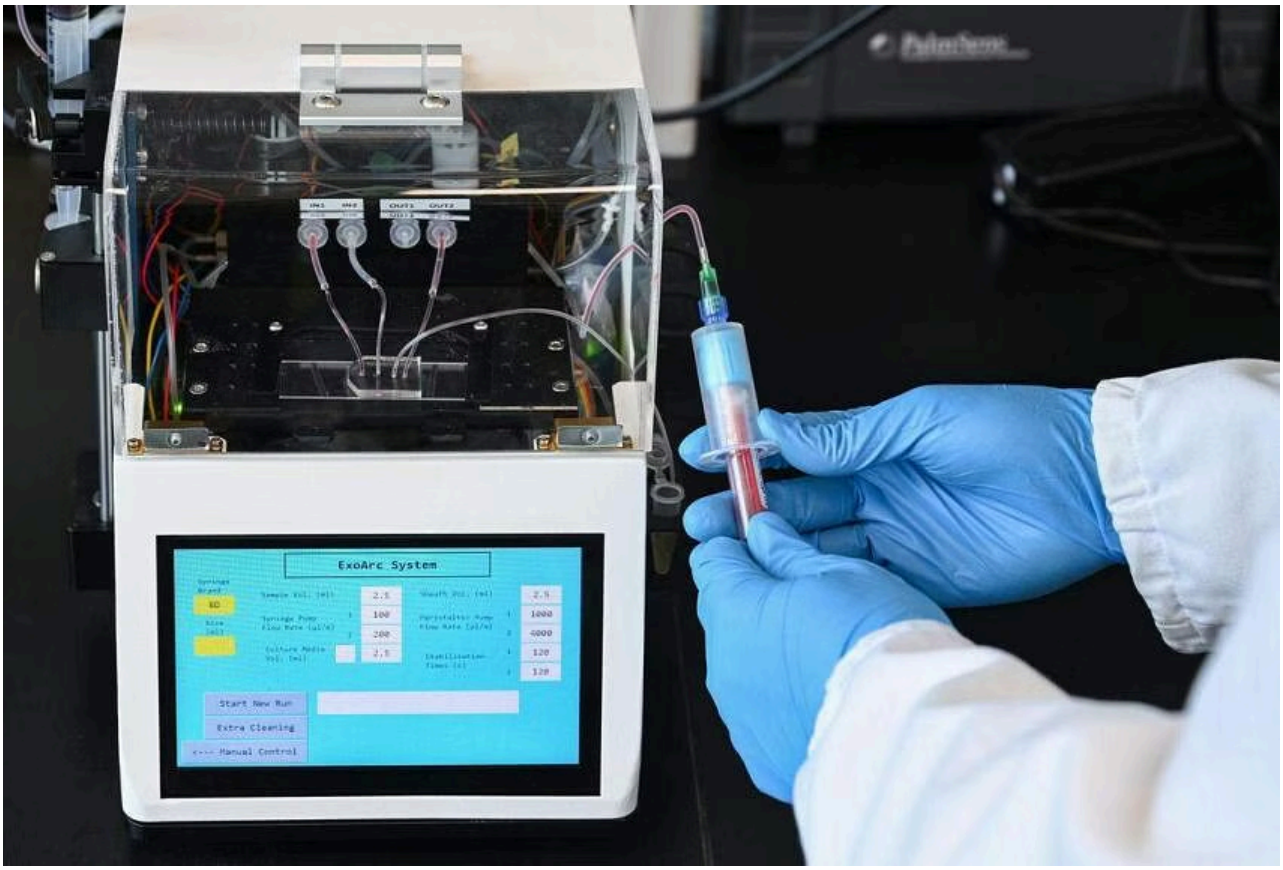
The desktop printer-sized machine comes with a touchscreen used to control the pressure and flow velocity affecting the efficiency of separating the biological materials and the purity of such materials.

Compared to other devices, this prototype is able to siphon biological particles that are smaller than a micron, which is about 100 to 200 times smaller than the diameter of a strand of human hair.

NTU's new method attains high blood plasma purity by removing more than 99.9 per cent of blood cells and platelets precisely and gently, which will speed up clinical analysis and screening for biomarkers that are telltale signs specific to certain cancers and diseases.

NTUitive, the university's innovation and enterprise arm, has filed two patent applications for ExoArc, and the team's findings have been recently published in a scientific journal, ACS Nano.

The research team plans to conduct large-scale clinical trials in the next one or two years.



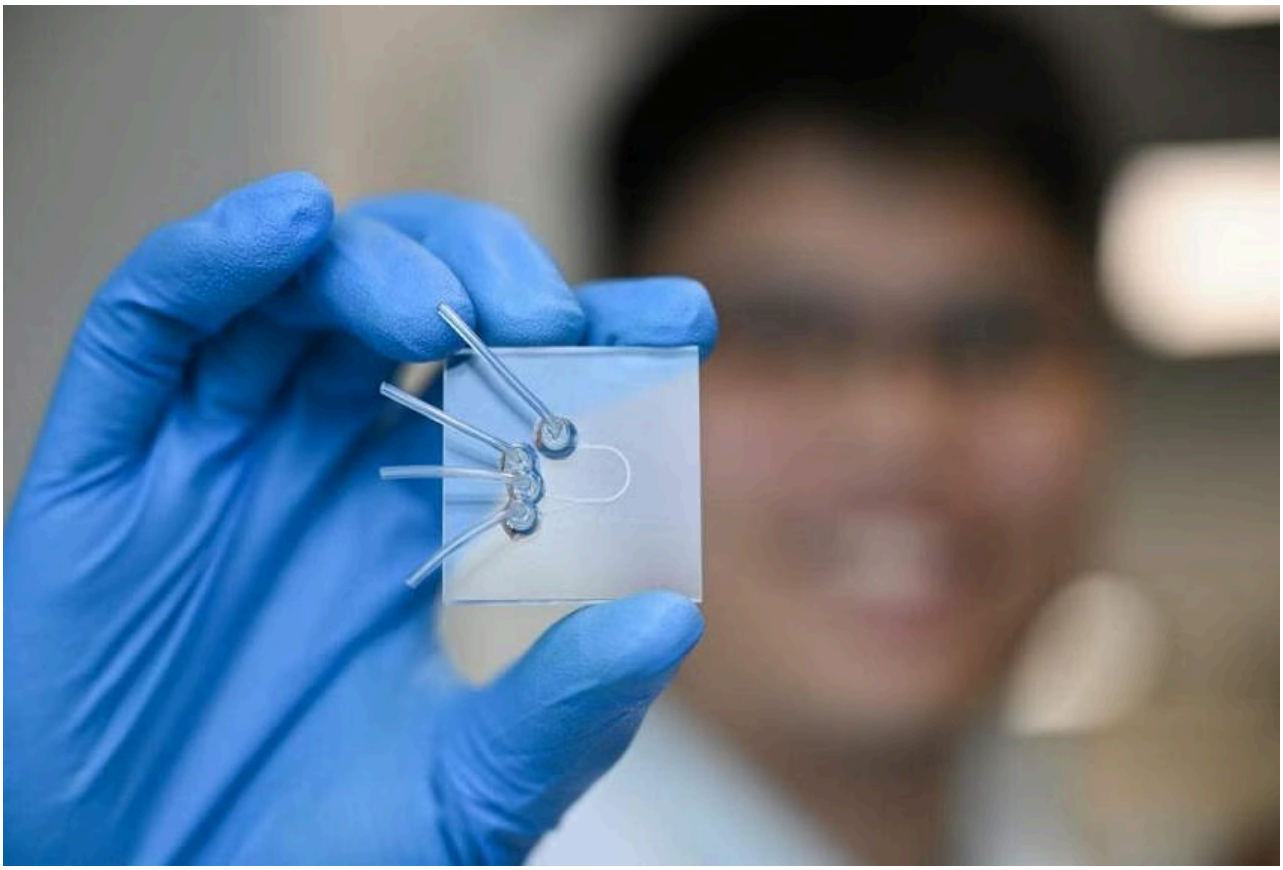
The ExoArc chip is connected to a machine with a touchscreen used to control the pressure and flow velocity affecting the efficiency of separating the biological materials and and the purity of such materials. ST PHOTO: SHINTARO TAY

Working with clinician-scientists from National Cancer Centre Singapore (NCCS), the NTU team analysed the microRNA profile of blood plasma in healthy people and cancer patients and found it was able to diagnose non-small cell lung cancer with a sensitivity of 90 per cent.

This collaboration allowed the team to test the clinical safety, effectiveness, and efficacy of the chip.

Professor Darren Lim, senior consultant of the medical oncology division at NCCS, who is a co-author of the research findings, said: “Our study shows that this device allows quicker and more precise clinical diagnoses, significantly decreasing the waiting time for test results, reducing patients’ anxiety and ultimately improving their overall care. This is particularly significant for cancer treatment.”

The NTU scientists also used ExoArc to analyse the microRNA profile of blood plasma in healthy people and individuals with Type 2 diabetes in a collaboration with Tan Tock Seng Hospital (TTSH). They found that the microRNA profile of those with Type 2 diabetes had a different composition as compared to healthy individuals.



The chip, measuring 3.5cm by 2.5cm and 0.3cm thick, has to be connected to a machine that pumps the blood into tubes to create a high flow pressure which separates the materials. ST PHOTO: SHINTARO TAY

Associate Professor Rinkoo Dalan, senior consultant specialising in diabetes and endocrinology at TTSH, said: "This technology can help clinicians better predict and manage complications of chronic metabolic conditions like diabetes, by providing more accurate, timely, and individualised information.

"By detecting specific biomarkers accurately, we can tailor treatments to the unique needs of each patient, potentially improving outcomes and enhancing the quality of care."

Associate Professor Hou Han Wei, lead scientist of the research team, said that they are currently looking at using ExoArc to diagnose infectious diseases as the chip can be customised to isolate bacteria from blood.

Professor Roger Foo, Zayed bin Sultan Al Nahyan Professor of Medicine at the National University of Singapore (NUS), said the patent-pending chip is potentially a game changer, as it reduces the effort to obtain and purify blood samples significantly since markers in the blood can be very noisy signals.

"Any means to purify the sample to amplify the signal-to-noise ratio will help us to do clinical tests more meaningfully, robustly and consistently," said Prof Foo. He is the director of Cardiovascular Metabolic Disease Translational Research Programme at National University Health System, and the vice-dean for research at NUS Yong Loo Lin School of Medicine.

Commending the NTU team of scientists on their new method of isolating blood plasma, he added: "I believe the team has ambition for this chip to become widely used in hospital labs around the world, and I can see the potential for this to get there. The next step is proving that value towards that end."

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