Tailoring treatment for cancer patients

NUS team finds faster way to grow tumour clusters for drugs to be tested on them

Samantha Boh

Scientists here are a step closer to developing cancer treatments tailored for individual patients, which are more effective and less time-consuming.

Their dream is for such customised treatments to replace current ones that are delivered largely through trial and error.

At present, a doctor administers a drug at a dosage that he thinks will shrink a patient's tumour, based on factors like the stage and type of cancer. But if it does not, then the dosage is altered or a second drug is used, and so on.

A team of local scientists from the National University of Singapore (NUS) has come up with a way to take all these steps outside of the human body – by extracting cancer cells from patients, growing them in the laboratory, and then testing drugs on them.

This process enables the scientists to find out which drug, or combination of drugs, will work best to kill the cancer cells in each patient, potentially shortening treatment time and reducing side effects.

"The aim is to give the right drug, to the right patient, at the right time and right dosage," said Professor Lim Chwee Teck, principal investigator of the Mechanobiology Institute. He led the research with Dr Khoo Bee Luan, senior postdoctoral associate at the Singapore-MIT Alliance for Research and Technology. Dr Khoo conducted the research as an NUS PhD student.

The procedure starts with the prick of a needle. All they need is 7.5ml of blood, which is about 1½ teaspoons. The patient's blood sample is then put through a device where circulating tumour cells – which are cancer cells that have broken away from a primary tumour to form secondary tumours – as well as white blood cells are separated from red blood cells, plasma and platelets.

Next, the cancer cells and white blood cells are placed in another device, where they are inserted into microwells – which to the naked eye look like dots made by a pen.

The device containing rows of microwells is then placed in an incubator which mimics the conditions within the human body.

The idea, said Prof Lim, is to grow the cancer cells into tumour clusters large enough for drugs to be tested on them. His team is able to grow tumour clusters in two weeks, much faster than other methods, which take between two and six months.

They have also succeeded more than half of the time, which is twice the success rate of other methods.

Once the tumour clusters have formed, a drug or a combination of drugs, in different concentrations, is injected, and the team will be able to analyse how the tumour responds to the drug in two days.

The device has been tested on more than 400 samples, largely from breast cancer patients. Some were taken from patients suffering from lung cancer, as well as head and neck cancer. The findings were published in the scientific journal Nature Protocols recently.

The key to their success in growing tumour clusters is the white blood cells.

"Research suggests there is a combination of white blood cells and cancer cells in a tumour. The white blood cells somehow encourage the cancer cells to grow," said Prof Lim.

Other groups which separate the cancer cells from the white blood cells and other components of blood have had a lower success rate of about 2 to 20 per cent.

The team is in discussions with companies which are interested in commercialising the device. The next step would be to get approval from regulatory bodies to trial the device in clinics.

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GETTING IT RIGHT

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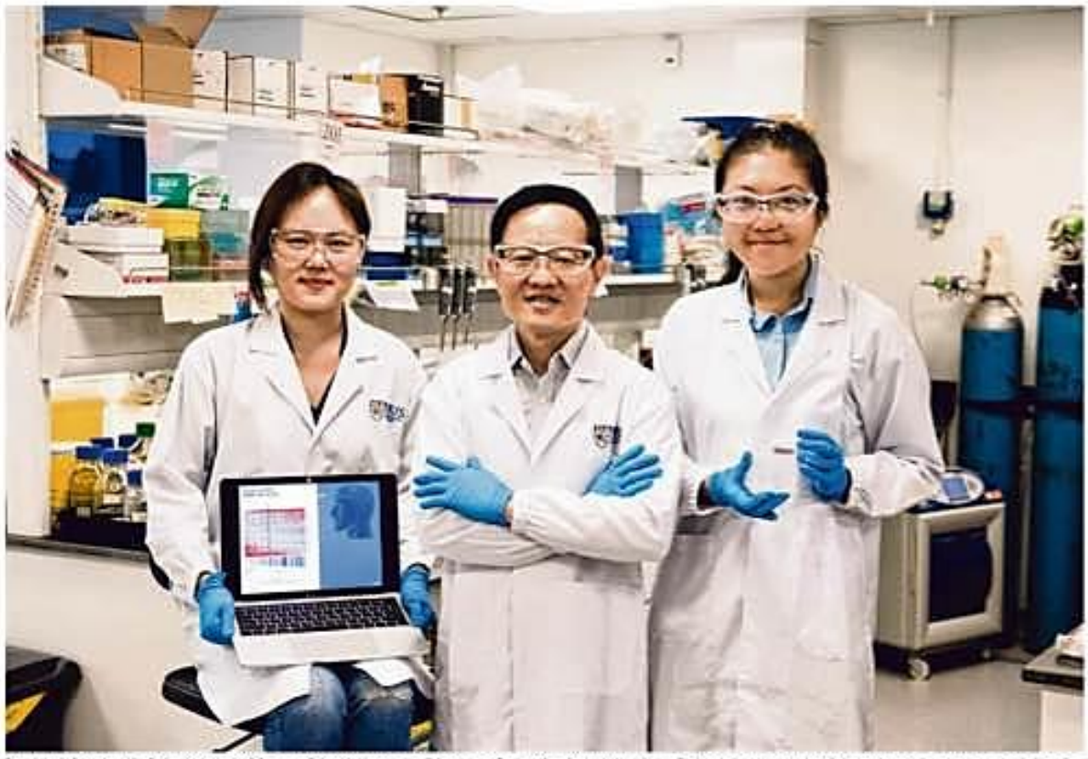
PROFESSOR LIM CHWEE TECK principal investigator of the Mechanobiology Institute, on the team's work.

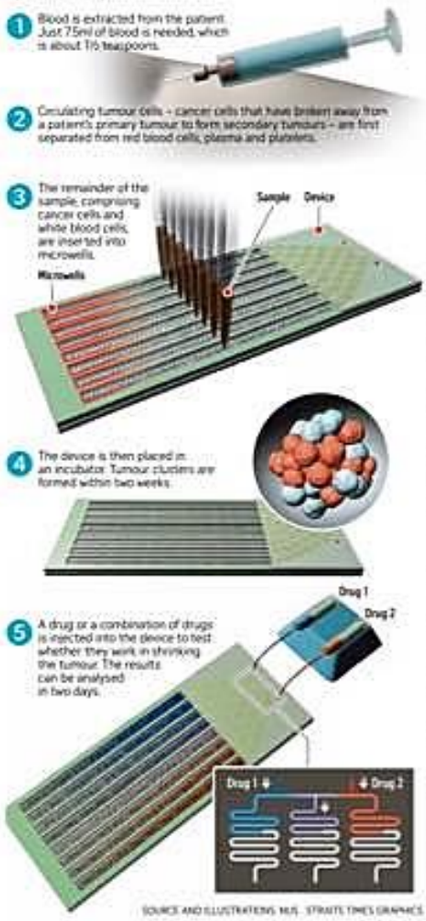


From left: PhD student Lim Su Bin from the NUS Graduate School for Integrative Sciences and Engineering; Professor Lim Chwee Teck, principal investigator of the Mechanobiology Institute; and Dr Khoo Bee Luan, senior postdoctoral associate at the Singapore-MIT Alliance for Research and Technology, in an NUS laboratory with their research projects. ST PHOTO: LEE JIA WEN

Growing tumours in tiny wells

Scientists from the National University of Singapore have developed a device which can grow cancer cells extracted from the blood of patients into tumour clusters, and which allows drugs to be tested on these tumours in different dosages and combinations. Eventually, the device could help doctors to come up with treatment customised for individual patients.

How it is done



SOURCE AND ILLUSTRATIONS: NUS · STRAITS TIMES GRAPHICS

Using genetic data to predict outcomes

After trawling through the genetic data of tumours from thousands of early-stage lung cancer patients, local scientists have pinned down 29 genes that could be used to predict how well patients with the cancer will respond to treatment.

These genes could also predict survival outcomes.

The research team from the National University of Singapore (NUS) focused on non-small cell lung cancer (NSCLC), which makes up more than 80 per cent of lung cancers here.

They zoomed in on the space between cells, called the extracellular matrix, which provides structural and biochemical support to surrounding cells.

"Studies have shown that tumours need a scaffold to grow, which seems to be a hallmark of cancer across cancer types," said Professor Lim Chwee Teck from NUS' department of biomedical engineering, who co-led the NUS research.

An abnormal extracellular matrix is known to affect cancer progression.

"We wanted to find out which components or molecules matter in the cancer cell grown," said PhD student Lim Su Bin from the NUS Graduate School for Integrative Sciences and Engineering, who is the other co-leader of the research.

After studying the tumours of more than 2,000 patients with early-stage NSCLC, the team identified 29 genes produced in the extracellular matrix that affect a patient's prognosis.

The findings were published in scientific journal Nature Communications recently.

The team found that more of the genes were produced when the cancer was more advanced.

They also developed a scoring system based on the amount of the genes produced, where patients with a higher score had a poorer overall survival.

However, those with high scores were also found to benefit more from chemotherapy.

The team is studying if the 29 genes can be used to predict treatment outcomes in 11 other cancer types, including breast, stomach and colon.

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