Culling cancer before it stems: A novel, rapid carcinogen detection method

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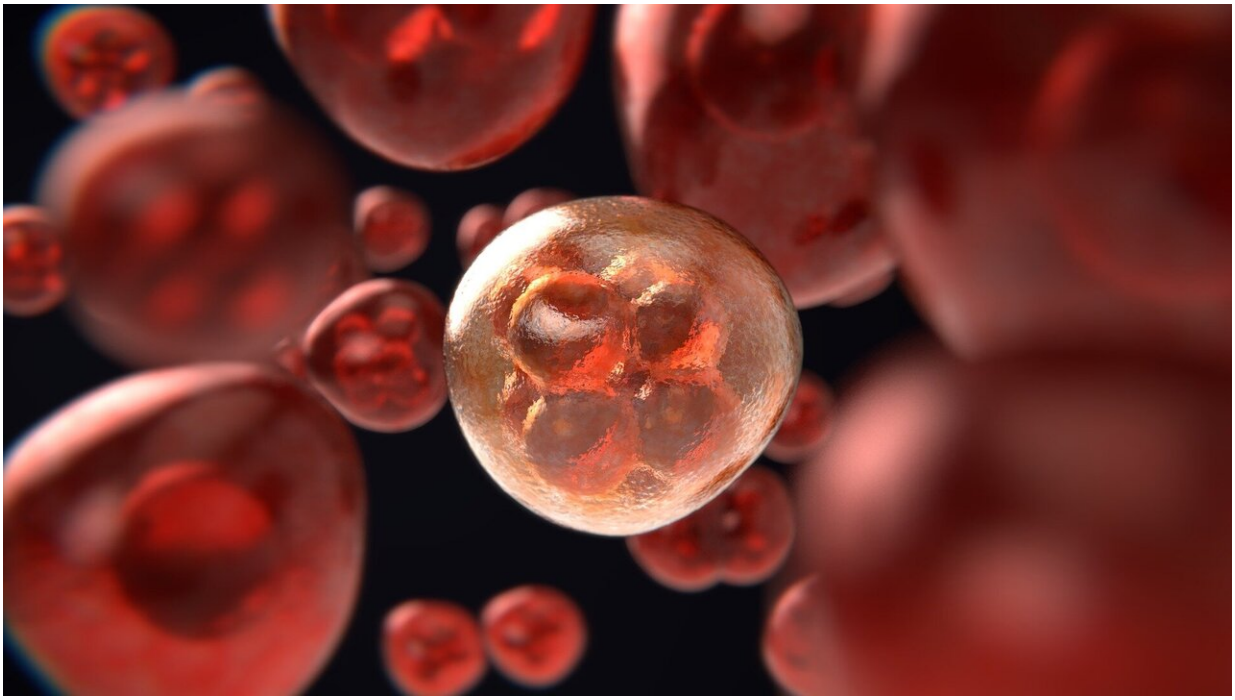

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Today, our lifestyle brings us in contact with multiple chemicals daily: in packaged food, cosmetics, construction materials, aerosols, and so on; a number of these chemicals have been named 'carcinogens.' A chemical's carcinogenicity is its ability to cause cancer in humans or other living things. Because cancer is a major cause of illness, disability, and death worldwide, scientists have developed several different ways to test

chemicals for carcinogenicity in the laboratory. However, these methods are complex and take a long time to yield results, which make it difficult for scientists to test large numbers of chemicals.

Now, in a paper recently published in *Scientific Reports*, an international research team led by Professor Masaharu Seno of Okayama University, Japan, reports a new method that can achieve this quickly. "It takes only one week for our method to yield results," notes Prof Seno, and this represents a considerable improvement over existing methods.

The method involves stem cells—precursor cells that mature into various different cells with specialized functions, such as blood cells or neurons. Previously, Prof Seno's research team had used a certain kind of stem cell from mice, called mouse induced pluripotent stem cells, to establish a model in which healthy stem cells converted to "cancerous" stem cells, also called cancer stem cells (or CSCs), in four weeks when kept in a conditioned culture medium of mouse lung cancer cells. In this study, the researchers reasoned that adding a carcinogenic chemical to the conditioned medium should boost this conversion.

Based on this idea, the researchers conducted a series of week-long experiments to test 110 chemicals. At the end of it, they found that three chemicals—namely, PDO325901, CHIR99021, and Dasatinib—had resulted in the formation of CSCs. What's interesting is, all three are actually known to suppress the intracellular signaling that leads to the growth and survival of cancer cells.

When they injected live mice with stem cells that had been exposed to any of those three chemicals, malignant tumors grew in the mice within six weeks. The CSCs obtained by exposing mouse stem cells to the three chemicals also began making more copies of proteins often associated with the growth of cancer cells.

Upon additional analyses, the scientists were able to identify the specific cellular pathways that these chemicals all trigger to cause the conversion.

These findings prove the efficacy and potential of this rapid testing method. Prof Seno speaks of the many applications the method can have: "Because pluripotent stem cells can develop into all cells in an adult human body, a wide range of cancer stem cells can be obtained with our method, enabling the efficient risk assessment of many chemicals for a variety of cancers. This will lead to more precise cancer prevention strategies as well as treatments." He also asserts that this screening method will be "a good resource for studying the mechanisms of cancer development."

Given how many people are afflicted worldwide by cancer every year, methods such as the ones developed in this study and its precursor can make important contributions to the improvement of people's lives.

More information: Juan Du et al, Signaling Inhibitors Accelerate the Conversion of mouse iPS Cells into Cancer Stem Cells in the Tumor Microenvironment, *Scientific Reports* (2020). DOI: 10.1038/s41598-020-66471-2

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