Anti-tumor drugs tested by microfluidic device

October 5 2010

A prototype device developed in Hong Kong will allow laboratory researchers to non-invasively test drugs for their ability to kill tumors by subjecting cancerous cells with different concentration gradients. The new device is built upon microfluidics -- a set of technologies that allows the control and manipulation of fluids at the sub-millimeter scale -- and is described in the American Institute of Physics' journal *Biomicrofluidics*.

Microfluidic valves within the device, said Hongkai Wu of Hong Kong University of Science and Technology, accurately meter different solutions and mix them to form a stepwise succession of gradients. Then assays measuring cell apoptosis are applied. The device integrates a previously validated analysis method that quantifies the apoptotic process at the level of single cells in real-time.

For this test, researchers measured the activity of the drug etoposide in HeLa cells. Etoposide is a commercially available anticancer compound commonly used in chemotherapy. HeLa cells, derived from human cervical cancer cells, are a line of cells frequently used in research.

The device allows researchers to study the cytotoxicity of multiple concentrations of a drug in parallel on one chip, saving both time and labor and reducing errors caused by variations in conditions often found in larger-scale testing. Also, microfluidic chambers within the device allow long-term tracking of individual cells through fluorescent microscopic imaging that offers high optical sensitivity.

With some other in vitro tests, like DNA analysis, cells need to be killed in order to be studied. In this analysis method, a change in fluorescence occurs when caspase-3, an indicator of cell apoptosis, is activated. In Wu's test, increasing concentrations of etoposide demonstrated correspondingly higher activation of caspase-3. In a control-group chip without etoposide, caspase-3 was not activated.

Wu also said that, "Unlike conventional methods, the microfluidic device permits quantitative data to be obtained from individual cells; the device requires fewer numbers of cells and allows testing of amounts of reagents reduced by about 4 orders of magnitude. In a conventional 96-well plate study, each well is around 1 centimeter, while in our microchip device, each cell chamber has a dimension of hundreds of microns. Reducing the sample size has significant merit because in most cases, the biomolecules in use are extremely expensive, even in quantities in milligrams or less."

While this report concerns a test of five ladder channels on a single chip, higher throughputs should be possible, Wu stated. "This prototype system should be useful in the areas of biology and bioengineering, especially for discovering apoptosis-inducing agents," Wu concluded.

More information: bmf.aip.org/

Provided by American Institute of Physics