Researchers create more powerful 'lab-on-a-chip' for genetic analysis

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UBC researchers have invented a silicone chip that could make genetic analysis far more sensitive, rapid, and cost-effective by allowing individual cells to fall into place like balls in a pinball machine.

The UBC device – about the size of a nine-volt battery – allows scientists to simultaneously analyze 300 cells individually by routing fluid carrying cells through microscopic tubes and valves. Once isolated into their separate chambers, the cells' RNA can be extracted and replicated for further analysis.

By enabling such "single-cell analysis," the device could accelerate genetic research and hasten the use of far more detailed tests for diagnosing cancer.

Single-cell analysis is emerging as the gold standard of genetic research because tissue samples, even those taken from a single tumour, contain a mixture of normal cells and various types of cancer cells – the most important of which may be present in only very small numbers and impossible to distinguish.

So standard genetic tests, which require large numbers of cells, capture only an average "composite picture" of thousands or millions of different cells – obscuring their true nature and the interactions between them.

"It's like trying to trying to understand what makes a strawberry different

from a raspberry by studying a blended fruit smoothie," says Carl Hansen, an assistant professor in the Dept. of Physics and Astronomy and the Centre for High-Throughput Biology, who led the team that developed the device.

The device, described and validated in this week's issue of the Proceedings of the National Academy of Sciences, was developed by Hansen's team, in collaboration with researchers from BC Cancer Agency and the Centre for Translational and Applied Genomics.

The device's ease of use and cost-effectiveness arise from its integration of almost the entire process of cell analysis – not just separating the cells, but mixing them with chemical reagents to highlight their genetic code and analyzing the results by measuring fluorescent light emitted from the reaction. Now all of that can be done on the chip.

"Single-cell genetic analysis is vital in a host of areas, including stem cell research and advanced cancer biology and diagnostics," Hansen says. "But until now, it has been too costly to become widespread in research, and especially for use in health care. This technology, and other approaches like it, could radically change the way we do both basic and applied biomedical research, and would make single-cell analysis a more plausible option for treating patients – allowing clinicians to distinguish various cancers from one another and tailor their treatments accordingly."

Provided by University of British Columbia