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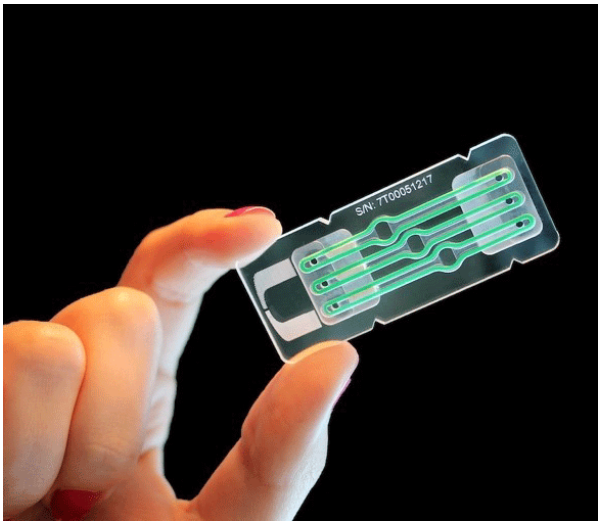
# Dynamic Organ on a Chip Device Developed at UM Advances the Study of Pancreatic Islet Cells

The days of researchers studying cells in static cultures, making a best guess as to how *in vitro* experiments mimic cells within an organ, and having to beat the clock to run assays within the hours cells stay viable may soon be over.

Ashutosh Agarwal, Ph.D., and collaborators have developed a chip technology that overcomes many previous limitations for researchers – for example, attempting to mimic how islet cells react to glucose levels and secrete insulin. Their findings are reported in a study in *Science Advances* published February 12.




The pancreas on a chip platform.

Potential advantages for people with diabetes include protection against immune attacks, sustaining the functional lifetime of islet cells, and integrating islet cells within the person's own blood supply, Dr. Agarwal said.

Mature stem cell-derived islet cells could even one day produce insulin, obviating the need for insulin shots, said Dr. Agarwal, associate professor of biomedical engineering, biochemistry, and molecular biology at the University of Miami Miller School of Medicine.

The chip is designed as a long-term, dynamic culture that continuously provides nutrients to cells within a hydrogel. This allows the cells to remain viable for days instead of hours, and also expands the number and type of experiments that can be conducted.

"Think of these chips as histology into a particular patient without cutting into the patient," Dr. Agarwal said.

"Our chips enable, for the first time, multiple serial assessments – imaging, stimulation, and hormone secretion – on the same piece of tissue at the same time," he said. "Collecting multiple functional readouts, over a long period of time without sacrificing the tissue, has proven useful to multiple labs that now use our chips."

In the study, Dr. Agarwal and colleagues demonstrated the superiority of their Acry-Chip and Oxy-Chip systems (Bio-Vitro Inc.) compared with traditional, static lab cells cultures.

Furthermore, exposing the islet cells evaluated on the Acry-Chip or Oxy-Chip to high levels of glucose triggered robust

stimulation, mimicking what occurs in the pancreas. In contrast, the static cells cultures only demonstrated minimal responses under the same conditions. The static cells cultures stopped releasing insulin overnight, compared with at least 5 to 10 days of activity of the cells nourished on a 3D matrix developed as part of the study.

“With the rapid development and deployment of organ on chip platforms both from my lab and many other academic labs, as well as commercial entities, there is almost no excuse to culture cells in totally artificial static and stiff environments of multi-well plastic dishes and flasks,” Dr. Agarwal said.

The testing of 3D matrices was done along with study lead co-author Cherie Stabler, Ph.D., and collaborators at the Stabler Lab at the University of Florida. “These matrices are being developed to provide multiple benefits to an eventual islet transplant construct for a type 1 diabetic patient,” Dr. Agarwal said.

In terms of commercial applications, Dr. Agarwal and collaborators are working with the University of Miami to further develop their company based on this technology, Bio-Vitro Inc., and to provide the chips to other islet biology and immunology laboratories.

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