New technology platform propels the use of 'organs-on-chips'

March 8 2017

A research team led by scientists from Brigham and Women's Hospital has developed a novel technology platform that enables the continuous and automated monitoring of so-called "organs-on-chips"—tiny devices that incorporate living cells to mimic the biology of bona fide human organs.

One of the major technical challenges in using organs-on-chips is that current methods for measuring their responses are done mostly by hand, making it difficult to conduct long-term studies that seek to closely model human physiology and responses. Moreover, these measurements require the removal of relatively large volumes of fluid. If repeated several times, they can deplete the liquid in the system, rendering it inoperable.

The scientists, led by first author Yu Shrike Zhang together with senior author Ali Khademhosseini, created several innovations to address these challenges. These include the development of a biochemical sensor that can continuously and accurately measure different substances released by the organ-like system, as well as enhancements that allow the use of multiple physical sensors, which monitor features such as temperature, oxygen levels, and pH values.

In addition, they engineered a central router or "breadboard" that controls fluid flow to different components of the network. Equipped with a series of channels and valves, this breadboard functions as kind of circulatory system that enables researchers to program when and how

often liquid runs through specific organs or sensors. The modular design further allows convenient replacement of individual modules when necessary. Zhang and his colleagues were able to use this approach to integrate a variety of different sensors.

"Our system is highly flexible and modular, so it can be readily adapted for use with different types of pre-existing chips and research applications," explains Zhang. "We hope this will expand the use of organs-on-chips in a variety of contexts, including drug screening and drug toxicity studies," adds Khademhosseini.

More information: Yu Shrike Zhang et al. Multisensor-integrated organs-on-chips platform for automated and continual in situ monitoring of organoid behaviors, *Proceedings of the National Academy of Sciences* (2017). DOI: 10.1073/pnas.1612906114

Provided by Brigham and Women's Hospital