New technique advances bioprinting of cells

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Ever since an ordinary office inkjet printer had its ink cartridges swapped out for a cargo of cells about 10 years ago and sprayed out cell-packed droplets to create living tissue, scientists and engineers have never looked at office equipment in quite the same way. They dream of using a specialized bio-inkjet printer to grow new body parts for organ transplants or tissues for making regenerative medicine repairs to ailing bodies. Both these new therapies begin with a carefully printed mass of embryonic stem cells. And now there's progress on getting that initial mass of stem cells printed.

By extending his pioneering acoustical work that applied sound waves to generate droplets from fluids, Dr. Utkan Demirci and his team at Harvard Medical School's (Brigham and Women's Hospital) Bio-Acoustic Mems in Medicine Laboratory report encouraging preliminary results at an early and crucial point in a stem cell's career known as embroid body formation. Their research results appear in the journal *Biomicrofluids*, published by the American Institute of Physics.

Getting the embroid body formed correctly and without mechanical trauma is key to preserving the stem cells' astounding ability to develop into any desired tissue. Their new automated bioprinting approach appears to do this better than manual pipetting in the "hang-drop" method traditionally used.

Notes Dr. Demirci: "To have the capability to manipulate cells in a high-throughput environment reliably and repeatedly, whether it is a single cell or tens of thousands of cells in a single droplet, has the potential to

enable potential solutions to many problems in medicine and engineering."

Three research results stand out:

- Enhanced uniformity of size and ability to control droplet size. These are key variables because they determine how the embroid bodies will grow.
- Achieving a scalable system that can print one cell or tens of thousands per droplet—a level of precise manipulation not previously available.
- Faster droplet formation. The new system delivers 160 droplets/seconds, versus 10 minutes for the hang-drop method.

The next step involves assessing the two methods to compare their effects on cell function. Says Dr. Demirci: "We are eager to take it to the next level."

More information: The article, "Embryonic stem cell bioprinting for uniform and controlled size embryoid body formation," by Feng Xu, Banupriya Sridharan, SuiQi Wang, Umut Gurkan, Brian Syverud, and Utkan Demirci, appears in the journal *Biomicrofluidics*.

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