New culture dish could advance human embryonic stem cell research

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A new synthetic Petri dish coating could overcome a major challenge to the advancement of human embryonic stem cell research, say University of Michigan researchers.

Under today's regulations, current stem cell lines have limitations in yielding human therapies because the cells have been grown on animal-based substances that don't behave in predictable ways.

"These nondefined, animal-based components create issues with the FDA (the U.S. Food and Drug Administration) and hinder clinical applications," said Joerg Lahann, associate professor of chemical engineering.

Lahann and Gary Smith, an associate professor in obstetrics and gynecology in the U-M Health System, and their co-workers built a new stem cell growth matrix that is completely synthetic and doesn't contaminate the stem cells with foreign substances that could interfere with their normal function.

A paper on the research was published online this week in Nature Biotechnology.

Today's most commonly used matrices are mouse embryonic fibroblast cells and Matrigel, which is made from mouse tumors.

"The problem is that the mouse-derived cells have batch-to-batch

variability, and they secrete factors that nobody really understands. Stem cells are very sensitive to their environment," Lahann said.

The unknown factors hamper researchers' attempts to pinpoint how and under what conditions stem cells differentiate---questions paramount to the development of future stem cell therapies.

The team tested six different polymer coatings and found that a water-soluble gel with the acronym PMEDSAH performed well when attached to the Petri dish even after 25 rounds of harvesting stem cells to grow new colonies.

"We have designed a fully synthetic, fully chemically defined hydrogel that has long-term stability and no batch-to-batch variability," Smith said. "Moreover, we have established that it can be used for long-term growth of human embryonic stem cells while maintaining all of their known normal functions.

"These include normal genetic makeup, lack of spontaneous differentiation and maintenance of pluripotency, which means they can still become any cell type of the human body. This is a perfect example of an interdisciplinary collaboration leading to information gained and future discovery of cures and improvements of human health."

Smith is also an associate professor in the departments of Molecular and Integrative Physiology and Urology, as well as director of the Reproductive Sciences Program. Lahann is also an associate professor in the departments of Materials Science and Engineering and Biomedical Engineering.

More information: The paper is called "Synthetic Polymer Coatings for Long-term Growth of Human Embryonic Stem Cells."

Provided by University of Michigan