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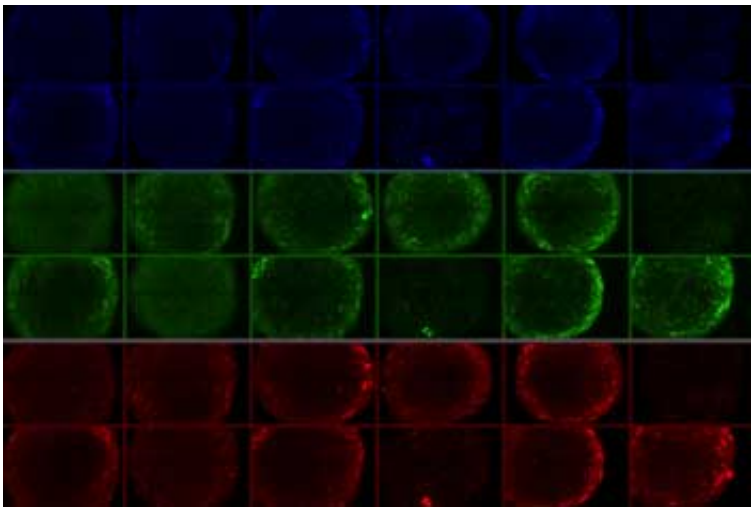
New stem cell processing promises faster, more reliable research

By Katherine Harmon



Stem cells have been touted as potential antidotes to nearly everything ranging from blindness to paralysis, as well as valuable models on which to study disease. But in order for researchers to discover and refine new cell-based treatments, they need plenty of cellular subjects.

When cultured correctly, both human embryonic (hES) and induced pluripotent stem (iPS) cells can renew in perpetuity. But growing these cells in the lab can be a tricky process. Culturing them has required placing them on a "feeder" layer of animal (usually mouse) cells, which can cause variation and increased potential for immune system rejection when reintroduced into the human body. So finding a growing method that could remove some of that variability and rejection risk—and foster quick and even proliferation—could go a long way toward speeding stem cell research.

A team of scientists has found an effective synthetic material on which they were able to expand single stem cells into colonies of identical cells and keep them alive for as long as three months. The group described their work in a paper published online August 22 in *Nature Materials* (*Scientific American* is part of Nature Publishing Group).

Not just any protein-coated Petri dish will do for this kind of careful culturing. "The surface properties of cell-culture substrates can modulate both the amount and the conformation of adsorbed proteins, and thereby interact with cell surface receptors…to initiate signal transduction and alter cell behavior," noted the researchers in their study.

The research team, led by Ying Mei, of Massachusetts Institute of Technology's (MIT) Department of Chemical Engineering, used high-throughput testing to assess the fitness of about 500 different polymers—each with a different combination of texture, water affinity, rigidity and ingredients. The researchers coated these polymers with fetal bovine serum (which can be replaced with human serum for later research, according to the paper), seeded them with stem cells and let them grow for seven days.

After a week, the team found that some colonies had performed better than others, suggesting that "polymers can strongly modulate [stem] cell behavior," the researchers wrote. The group found that a polymer's so-called wettability seemed more important than texture and stiffness in influencing cell cultures, and that acrylates (often found in elastic plastics) helped improve a polymer's performance.

But more research remains to be done before the technology gets scaled up for medical lab work. "We want to better understand the interactions between the cell, the surface and the proteins, and define more clearly what it takes to get the cells to grow," Daniel Anderson, also of MIT and a coauthor of the paper, said in a prepared statement. A truly promising polymer-protein combination, however, could make more reliable—and economical—stem cell-based therapies

closer to a reality.

"For therapeutics, you need millions and millions of cells," Krishanu Saha, of the Whitehead Institute for Biomedical Research and coauthor of the paper, said in a prepared statement. "If we can make it easier for the cells to divide and grow, that will really help to get the number of cells you need to do all of the disease studies that people are excited about."

Image of hES being grown on synthetic surface courtesy of Ying Mei/Krishanu Saha/Robert Langer/Rudolf Jaenisch/Daniel G. Anderson