An Interview with Dr. Krishanu Saha from the Whitehead Institute of Biomedical Research

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An Interview with Dr. Krishanu Saha from the Whitehead Institute of Biomedical Research: On the invention of a new Synthetic Surface for the Cultivation of Human Stem cells for up to three months.

Scientists at MIT have developed a novel synthetic surface for the cultivation of human stem cells. The research team, led by Professors Robert Langer, Rudolf Jaenisch and Daniel G. Anderson, describes the new material in the Aug. 22 issue of Nature Materials. First authors of the paper are postdoctoral associates Krishanu Saha and Ying Mei. The new material was singled out of almost 500 polymers designed during the course of the study, and was found to be optimal after analysing several chemical and physical properties of surfaces, including roughness, stiffness, and affinity for water that might play a role in stem cell growth. The new surface not only enabled Stem Cells to be grown for up to three months but also enabled harvesting of cells in the millions. Both of these attributes are very important to researchers as the in vitro culture of human Stem cells is fraught with difficulty. The surface also enables clonal growth of a stem cell allowing for easy selection of a particular cell with attributes of interest. As Researchers laud this important invention, Biotechwiz is proud to present an exclusive interview with Dr. Krishanu Saha, one of the authors of this seminal work. An excerpt of the interview is presented below:

Dr. Krishanu Saha

Biotechwiz: Why did you feel the need to develop a new material for the growth of stem cells?

Dr. Krishanu Saha: When we started this work, there were only a handful of culturing materials that were used to grow human embryonic stem cells. Most of these materials included components from animal sources. These animal-derived components are problematic for any cell therapy applications envisioned with these cells, because such components utilized during cell culture can increase the risk of immune rejection when such cells are injected into a patient. We therefore sought to explore whether a library of synthetic polymers coated with human-derived proteins could replace and improve on the conventional methods of growing human embryonic stem cells.

We also wanted to gain more molecular insight into how human embryonic stem cells grow outside of the body. Mouse embryonic stem cells have particular properties of cell growth and genetic manipulation that make them easier to work with in the lab. We wondered whether we could devise better culture conditions for human embryonic stem cells by systematically exploring stem cell growth on a diverse set of polymeric materials.

BW: Can you elaborate a bit on the nature of this new surface that you have developed and what is the most unique feature of your invention according to you?

Dr. Saha: The new surfaces can be synthesized entirely from standard chemicals. They utilize a particular chemistry that was not defined before this work to interact with a human protein, Vitronectin. The most unique feature is that it can support the long-term culture of fully dissociated human embryonic stem cells as well as the recently 'reprogrammed' human induced pluripotent stem cells.

BW: How soon do you think the research you have done will be available as a commercially viable product?

Dr. Saha: This question of technology transfer is a difficult one to predict. There are already a few commercial products based on other work with novel stem cell culture materials that was just published in May. So if we extrapolate from those cases, our work could be translated into products in less than a year. I believe the MIT technology transfer office is dedicated to ensuring that the materials get widely used.

BW: What is the trend your future research is likely to take?

Dr. Saha: I am generally interested in combining this work with recent advances in cellular reprogramming. Cellular reprogramming can produce embryonic stem cell-like cells called induced pluripotent stem (iPS) cells from virtually any human cell source, such as a blood sample or biopsy. I

believe there is a key role of materials and engineering to play in developing these iPS cells for disease modelling and regenerative medicine applications.

BW: Can you tell us about any one hurdle that bugged you the most during your work?

Dr. Saha: Finding common patterns in the material characteristics that controlled the growth of the human embryonic stem cells was challenging. We had hundreds of polymers with lots of data about surface chemistry, stiffness, and roughness that needed to be sorted and globally analyzed. At times, this seemed tedious, but it is part of the research process.

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