Stem Cell Research with Dr. Yolanda Vasquez

Dr. Vasquez is an assistant professor of Chemistry at Oklahoma State University and is heavily involved in the research on stem cells at the University. Her recent research in the topic contributed to the paper “Fine-tuning the degree of stem cell polarization and alignment on arrays of high-aspect ratio nanopillars”. The broad scope of the paper was looking at how there are lots of factors that influence the ability of stem cells to differentiate (become different types of cells), and the surface with which they interact is one of them. Mesenchymal stem cells are the specific type of stem cells that their study looked at. Regular stem cells can differentiate into any type of cell, making them very versatile, but with the mesenchymal stem cells, they are limited to a specific number of cells. They can differentiate into at most 10 types of cells, the main cells being bone cartilage and fat. As previously stated, the surface that the stem cell interacts with can help determine what type of cell it differentiates into. This has great applications in medicine as stem cells are used to regenerate tissue, and the surface on which it is bound must be thoroughly studied or else the stem cells might differentiate into something that is not desired.

Dr. Vasquez’s paper looked specifically at the elasticity of the surface and how it determines what it separates into. Their research team used silicon as the main surface, and then modified it so that the elasticity would change. This was done by using different patterns and spacing on the silicon, and then placing the mesenchymal stem cells on that surface and seeing how it interacts. What they found was that with larger spacing in the silicon, making it less rigid and more elastic surface, the cells became smaller and in some cases flattened and branched out. This is a change in morphology of the cell, and with a change in morphology, then comes a change in what type of cell the mesenchymal stem cell will differentiate into. This concept was apparent in Dr. Vasquez’s research as she states, ”the mesenchymal stem cell needs to have 3-D structure in order to successfully differentiate, and when the silicon wasn’t rigid enough, the cell wasn’t able to maintain the 3-D structure, and so it would not differentiate.”

The potential applications with stem cells are obviously enormous, and Dr. Vasquez’s study helps show how cells interact and how that can affect the cell differentiation. For example, if you are applying mesenchymal stem cells to a part of the body, you would only want to do so in an area where it can adhere to a rigid surface, such as bone, because if not, as her study showed, the stem cell would not successfully differentiate.

With such vast potential, there have been many ethical dilemmas in regards to the use of stem cells. These ethical dilemmas have had a direct impact of Dr. Vasquez’s research. She spoke about how her and her research team are currently looking at stem cell applications on treating COPD, which is a lung disease that makes breathing difficult, and that research in this area has been held back, especially in the United States, because of the misconception of stem cell research and how the stem cells are acquired. She points to how people think that babies are being killed to get stem cells, but in reality the cells are only taken from embryos that will be discarded. Furthermore, Dr. Vasquez speaks of how stem cells and their use have become an ethical issue due to the unpredictability of it all. For instance, when applying the use of stem cells in medicine, the cell must to differentiate into exactly what it is intended to. If it does not, it can result in cancers and many other problems.

Despite the ethical problems with stem cells, Dr. Vasquez is optimistic about the future of its uses, and her research on the topic is certainly playing a valuable role in furthering stem cell understanding.

**References**

Bucaro, Michael A., et al. “Fine-Tuning the Degree of Stem Cell Polarization and Alignment on Ordered Arrays of High-Aspect-Ratio Nanopillars.” *ACS Nano*, vol. 6, no. 7, 2012, pp. 6222–6230., doi:10.1021/nn301654e.