Increased Reliability of Stem Cells in the Clinical Setting Through Laboratory Research

Stem cell therapy is at the forefront of regenerative medicine and presents a promising future for several medical procedures. Stem cells have the potential to cure many medical conditions that do not have effective alternatives. These conditions include but are not limited to damaged cartilage, tendons, ligaments, neurological organs, and cardiac muscle. These conditions have a common characteristic of damage to slowly recovering tissue or non-recovering tissue. Despite natural recovery possibilities and durations, stem cells can be used to increase the functionality of tissue under these conditions.

To understand how stem cells have the potential to solve medical disorders it is helpful to first know the basis of what makes a stem cell a stem cell. There are two characteristics that distinguish stem cells from other cells. The first is that they have the capacity to renew themselves or recreate themselves under favorable conditions. The second characteristic, which is essential for comprehension, is that stem cells have the characteristic of being undifferentiated and the ability to further differentiate. In another form, stem cells are not a particular cell such as a skin, muscle, or neuro cell, however they can differentiate into these particular cells. Differentiation is the process where stem cells become a different cell type.

Stem cells and their ability to differentiate into other cells are used in the clinical setting to take the place of, as previously stated, slowly regenerating cartilage tissue, spinal cord tissue, etc. Stem cells are implanted/injected into the area of defect and the cells begin to differentiate into the desired cell type, or at least that is what is hoped. This is where a problem is presented in the area of stem cell therapy.

Injection of undifferentiated cells with the intention of producing, for example, cartilage cells may not always yield cartilage cells. The stem cells could differentiate into one of many other cell types which would not benefit the patient. In an interview, Dr. Yolanda Vasquez explains how she and her colleagues have made steps to solving this issue through laboratory research.

Dr. Vasquez and her peers developed a method by which stem cells can be intentionally differentiated outside of the body, in the lab, before being used clinically. She explained that the stem cells could be placed on silicone, the silicone’s surface featured an array, or a series, of pillars protruding from the flat surface. After a period of time the stem cells, due to the surface they were exposed to would differentiate. When Dr. Vasquez and her peers changed the parts of the silicone, eg. the length of the pillars and therefore their stiffness or the space between the pillars, the differentiation characteristics observed would vary.

In short, the stem cells responded to the physical stimulation they received from the arrangement of the pillars that made up the surface of the silicone. The silicone could be manipulated in a fashions that that allowed Dr. Vasquez and other researchers to subjectively differentiate stem cells. Dr. Vasquez says this improves the reliability of stem cells to be used in the clinical setting. She made not that differentiating stem cells prior implantation will greatly reduce the chances of a stem cell differentiating to something that could be harmful to the patient’s body and increase the chance that the stem cells have to restore the function of the patient’s damaged tissue.

To see Dr. Vasquez’s work in whole look up Fine-Tuning the Degree of Stem Cell Polarization and Alignment on Ordered Arrays of High-Aspect-Ratio Nanopillars which can be found at Vasquezlab.okstate.edu under the publications tab.

References

Bucaro, Michael A., Vasquez, Yolanda., Hatton, Banjamin D., Aizenberg, Joanna. “Fine Tuning the Degree of Stem Cell Polarization and Alignment on Ordered Arrays of High-Aspect-Ratio Nanopillars” ACSNANO Vol. 6 No. 7 (2012) pg. 6222-6230

Vasquez, Y. (2018, April 11) Personal Interview.