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A 'fountain of youth' for stem cells?

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Researchers from the University of Hong Kong and the Massachusetts Institute of Technology have published a study in the current issue of *Cell Transplantation*, that explores ways to successfully keep stem cells "forever young" during implantation by slowing their growth, differentiation and proliferation.

"The successful storage and implantation of stem cells poses significant challenges for tissue engineering in the nervous system, challenges in addition to those inherent to neural regeneration," said Dr. Ellis-Behnke, corresponding author. "There is a need for creating an environment that can regulate cell activity by delaying cell proliferation, proliferation and maturation. Nanoscaffolds can play a central role in organ regeneration as they act as templates and guides for cell proliferation, differentiation and tissue growth. It is also important to protect these fragile cells from the harsh environment in which they are transplanted."

According to Dr. Ellis-Behnke, advancements in nanotechnology offer a "new era" in tissue and organ reconstruction. Thus, finding the right nano-sized scaffold could be beneficial, so the research team developed a "self-assembling nanofiber scaffold" (SAPNS), a nanotechnology application to use for implanting young cells.

"Fine control of the nanodomain will allow for increased targeting of cell placement and therapeutic delivery amplified by cell encapsulation and implantation," explained Dr. Ellis-Behnke.

The research team created the scaffold to provide a substrate for cell

adhesion and migration and to influence the survival of transplanted cells or the invasion of cells from surrounding tissue. The SAPNS they developed appear to slow the growth rate and differentiation of the cells, allowing the cells time to acclimate to their new environment.

"That delay is very important when the immune system tries attacking cells when they are placed in vivo," he further explained.

By manipulating both cell density and SAPNS concentration, the researchers were able to control the nanoenvironment surrounding PC 12 cells (a cell line developed from transplantable rat cells that respond to nerve growth factor), Schwann cells (glial cells that keep peripheral nerve fibers alive) and neural precursor cells (NPCs) and also control their proliferation, elongation, differentiation and maturation in vitro. They extended the method to living animals with implants in the brain and spinal cord.

The researchers concluded that the use of a combination of SAPNS and young cells eliminated the need for immuno-suppressants when cells were implanted in the central nervous system.

"Implanted stem cells are adversely susceptible to their new environment and quickly get old, but this study suggests a solution to conquer this problem," said Prof. Shinn-Zong Lin, professor of Neurosurgery at China University Medical Hospital, Taiwan and Chairman of the Pan Pacific Symposium on Stem Cell Research where part of this work was first presented. "The self-assembling nanofiber scaffold (SAPNS) provides a niche for the encapsulated stem cells by slowing down their growth, differentiation and proliferation, as well as potentially minimizing the immune response, thus enhancing the survival rate of the implanted stem cells. This allows the implanted stem cells to "stay forever young" and extend their neurites to reach distant targets, thereby re-establishing the neural circuits

This combination of stem cells and SAPNS technologies gives a new hope for building up younger neural circuit in the central neural system."

More information: www.ingentaconnect.com/content/cog/ct

Source: University of Hong Kong