EDITORIAL

Induced Pluripotent Stem Cells for Clinical Application; the working alternative for Embryonic Stem Cells?

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Just like the gold rush back in the 1840s, people fawn over stem cells, which are thought to be the potential miracle drug for Alzheimer's disease, spinal cord injuries, heart disease, and other diseases. The earliest developed stem cell and the most efficient one to produce is the embryonic stem cell. Many research in embryonic stem cells have reached the clinical trial phase, with mixed results for success rate. Despite the questionable efficacy of embryonic stem cell therapy, many people are willing to use that option with extravagant cost. Throughout the years however, the spotlight has shifted towards a new type of stem cells; the induced pluripotent stem cells (iPS Cells). One significant reason why this new type is highly favorable is the fact that producing it does not require the "killing" of embryos, thus eliminating the legal issues of conducting the research. There are, of course, downsides of iPS Cells compared to ES Cells, they are its very low efficiency and success rate of producing viable pluripotent stem cells, its potential to form tumors, and ironically the rising ethical issues related to iPS cells research and clinical application.

The problem with low success rate can be caused by several theories. The first theory is that the starting cell population is a mixture of a myriad of cell types. For example, the chunk of tissue to derive fibroblasts could contain a mix of subtly different cell types; even those that are fibroblasts will differ slightly in the mixture of proteins and other molecules they contain. In addition, cells that are grown in culture constantly shuttle back and forth between different states, which mean that the introduced reprogramming factors will affect each cell differently. Scientists are now trying to classify some of the cell types and working with reprogramming techniques to observe how and where they diverge.

In general there are two theories that might explain why iPS cells may form tumors. One is that iPS cells, in response either to reactivation of the reprogramming factors introduced into the cell, or through damage caused to the original cell genome through the artificial insertion of the reprogramming factors, form tumors. The second theory is that the remains of undifferentiated cells or other factors lead to the formation of teratomas. A potential solution for this would be to increase the iPS cell proliferation and differentiation and tumor formation using optimal reprogramming factors and optimal vectors.

One ethical issue that is applied to ES Cells is also used against iPS cells, which is the scenario evocative of science fiction; although iPS cells don't come from embryos, a scientist could induce the infinitely versatile cells to form sperm and eggs, and they might even cross the gametes in a laboratory dish to study aspects of human genetics. In addition, there is also the possibility of introducing human iPS cells into an embryo from a mouse or other animal, giving rise to a human-mouse chimera.

The donors of iPS cells could also face ethical issues regarding consent of the usage of their cells for a variety of research projects as well as the risk of having the donor's genetic information to be disclosed to the public, which incurs violating the donors' privacy. However possible the scenarios of science fiction are, the process of conducting research with that goal set in mind is too unlikely. For one, finding someone who would fund such research will be very difficult, and without funding automatically the research would come to a halt as well; thus preventing the scenario to happen. Another problem would be just having the idea of conducting such research is a very far out possibility. Researchers do not work on any topic they want, there are many considerations, with the lack of support and profit from conducting bizarre research as examples. As for issues concerning the donor, there are many ways to work around it, such as by having a scrutinized surveillance in the research process, and for certain cases, have the donor for the iPS cell the patients themselves.

Based on these points, there are still ways that the issues of iPS cells can be overcome.The potential threat of ethical issues for the clinical application and study in iPS cells can also be diminished. Even if there could be other new issues that will be brought up, the main ethical issue that ES Cells are stuck with has been removed; therefore giving iPS cells a potential regenerative medicine that could be safely, widely and effectively used for everyone.

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