

Stem cells derived without destruction of embryos

The promise of embryonic stem cells lies in their ability to be 'pluripotent' and develop into any cell/tissue type in the body. Therefore, experts realized and envisioned the future of stem cells in treating the host, by replacement of the diseased or injured tissue. A major roadblock to stem cell research though, is the ethical issue involved therein, due to killing of embryos for the extraction of stem cells in order to establish the stem cell lines. Therefore, the most basic objection to human embryonic stem (ES) cell research is rooted in the fact that ES cell derivation deprives embryos of any further potential to develop normally into a complete human being. ES cell lines are most conventionally isolated from the inner cell mass of blastocysts and, in a few instances, from cleavage stage embryos. So far, there are no reports in the literature of human stem cell lines derived using an approach that can work without embryo destruction. A long awaited goal of acquisition of embryonic stem cells for therapeutic use and other important applications, without the destruction of embryo, was recently claimed to be achieved¹ by the research team of Advanced Cell Technology in Worcester, Mass., USA. It was discovered that a few (1–2) embryonic cells could be taken from a live embryo (while in uterus) for the establishment of stem cell lines, leaving the embryo to survive and develop normally. This was considered to be a medical milestone and a major turning point, paving the way for beneficial gains in treating or curing diseases such as diabetes, spinal cord injuries and Alzheimer's disease. The technique not only claimed to circumvent the destruction of embryo, but also ensured that the biopsied cell does not develop into an embryo at any point and is only useful toward generating the stem cell lines. Robert Lanza, the leader of this team which has conducted this research, was quite optimistic about this breakthrough study, but he also expressed his concern in that, whether this strategy would grow and widen or not, will ultimately depend only on politicians rather than scientists. It also turns out that the report was followed by a backlash as it became clear that all of the embryos used in this study, were destroyed and there are no alive embryos remaining now after the execution of the

experimental protocols. Lanza as well as the journal *Nature* have been accused of hyping the results reported in the paper¹.

This study¹ has reported an improvised method described by the team earlier. In that study, the group succeeded in cultivating mouse embryonic stem cell lines by removing just one cell from the mouse embryo². The procedure is described to be similar to that used for pre-implantation genetic diagnosis (PGD), normally utilized to check for genetic disorders during *in vitro* fertilization (IVF). In this case the embryos survive, as the technique does not interfere with developmental potential of the embryo. The new research, however, took an extra painstaking effort, which deployed a very different technique. It involved the use of 16 human embryos left over from IVF. The group used single-cell biopsy technique to pluck one stem cell when the embryo was at the 8–10 cell stage. This is the same stage used for pre-implantation genetic diagnosis of the embryos. Excising a cell at this point and growing it further does not interfere with embryonic development. However, as the cells apparently do not like being co-cultured alone, they were put into a dish with other cells. This technique helped to keep them alive for a long time in culture conditions. Using this method, Lanza's team managed to get two stable lines that behaved like the conventional stem cell lines. The lines have been proven to be genetically normal and have been tested to generate all the cell types of the body to further prove their authenticity. These cells also retained the potential to form derivatives of all three embryonic germ layers both *in vitro* and in teratomas, a characteristic feature of stem cells.

The real importance of this study that involved ten different experiments, has the potential that we could indeed have the stem cell lines that are pluripotent from the embryos, which are not destroyed. With all the right kind of resources, we could thus recreate as many lines as the stem cell research community needs without unnecessarily harming or killing the embryos. That said, it was indeed very heartening to know that this study provided a major breakthrough in the derivation of useful stem cells lines for various medical applications in near future without serious concerns of any ethical, legal or economical issues, that

have been clouding this field of research for a long time.

However, this so-called 'ethical paper' which initially attracted media excitement, has been under attack for several reasons now. Many of the known experts in the field have also been disappointed over this confusion so soon after the Woo-Suk-Scatten scandal^{3–5}, in which they had claimed to create embryonic stem cell lines from cloned embryos⁴. Although the paper is not scientifically incorrect, it only shows 'a proof of principle' that a human embryonic cell line can be created from a single cell or blastomere, from a very early embryo which can survive but the reality is that none of the embryos survived in the experiments that were carried out. The *Nature* paper's details and the supplementary information later made it clear that all the embryos were broken up, stating that 91 cells were used from 16 embryos. Only two stem-cell lines were created, so the efficacy was barely 2% which is much lower than what appears to be at first glance. Within minutes of the paper going live, *Nature's* press office corrected its press release to say that Lanza's experiments had destroyed some of the embryos, but a second note two days later confirmed that all the embryos were destroyed. Thus, while some of the workers in the field consider this as a 'fraud', others say that the results of Lanza's paper are interesting although preliminary. Also, one school of thought suggests that whatever we learn from the human stem cell biology is going to be useful, while the other thinks it is not very clear whether this approach if applied to PGD embryos would resolve any ethical issues. Therefore, it would rather be more ethical to work on the embryos that are meant to be destroyed anyway.

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